PC MAGAZINE

PROGRAMMING

Visual Programming: 8 Packages That Speed Up Windows Apps Development

SOFTWARE

How Do You Rate Software Vendors? 1992 Readers' Survey

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GRAPHICS

Screen Capture and File Conversion: 10 Utilities That Do Windows

NETWORKING

NetWare, LAN Manager, And VINES: Testing The Limits of Network Operating Systems

JUNE 16, 1992 THE INDEPENDENT GUIDE TO PERSONAL COMPUTING VOLUME 11 NUMBER 11

50 MHz

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PC Magazine Tests 19 486/50s

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What do you want in a monitor?

MultiSync 4FG

Creating borders in Word for Windows was easy for test participants—they simply chose the easy-to-locate "Border" command.

Exotic Excursions
23 Cajun Court
New Orleans, LA 36857

May 15, 1992

Steve Sullivan
8762 W. 180th Pl.
San Diego, CA 98034

Dear Steve:

During the past two years **Exotic Excursions** has seen a record 200% growth in revenues. This success has been exciting, but we now must adjust for our very fast growth. The size of our office impedes proper customer service and is inadequate for the increased level of store traffic.

- I propose that we open another **Exotic Excursions** office, since our phenomenal growth of the past three years is likely to continue.
- ***Thousands of potential clients will attend the grand opening of the new Exotic Excursions office.***

Bold or italics? It was easy with one click of the mouse.

Creating a bulleted list was two steps in Word for Windows and 12 steps in WordPerfect for Windows.

My staff are currently inspecting some potential locations in the Bay Court Plaza. Rental agents have told us that almost 10,000 people pass through this retail space weekly on their way to offices, restaurants, and shops. The table below shows cost projections for three different space configurations.

Location	Floor	Meeting	Bath	Street	Cost/Sq.
Court A	4500	N	Y	Main	$2100
Court B	2100	N	N	Main	$590
Court C	3400	Y	Y	52nd	$1000

Word for Windows has an on-screen "Tables" function that lets you add rows almost instantly.

I recommend that we lease the Court C locatio[illegible]
It is substantiall[illegible]

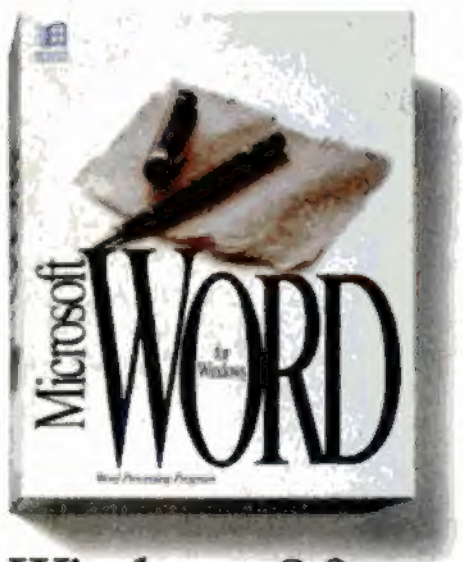
Exotic Excursions
23 Cajun Court
New Orleans, LA 36857

Steve Sullivan
8762 W. 180th Pl.
San Diego, CA 90834

Printing envelopes? Easy. We mean REAL easy. There's an envelope command right on the screen that addresses and prints automatically.

When given this simple letter to revise, WordPerfect for DOS users were impressed at how easy it was to perform everyday word processing tasks using Microsoft Word for Windows 2.0.

No wonder WordPerfect users prefer Word for Windows. It has easy written all over it.



In a recent test conducted by the National Software Testing Labs (NSTL), nearly eight out of 10 WordPerfect* for DOS users preferred Microsoft® Word for Windows™ 2.0 over WordPerfect for Windows. The reasons were plenty.

They were amazed at how Word for Windows put them one step away from accomplishing everyday word processing tasks with, in many cases, one simple click of the mouse. Which may have surprised them. But it didn't surprise us. After all, we designed Word for Windows around them.

Every week during the development of Word for Windows, we invited WordPerfect users to bring in their letters, memos, or whatever business documents they use in their own jobs, and try them out using Word for Windows. Our Product Development people at Microsoft called these sessions "usability studies." Which is just a fancy, shorter way of saying "what-do-people-use-a-word-processor-for-and-how-can-we-make-it-easier-for-them-to-use-it."

These studies not only helped us to design features that make everyday tasks easier, but helped us to make the more advanced word processing features like grammar checking, drawing and charting, easier to use as well.

Call for a free "Word Challenge Kit." Included is a videocassette highlighting the test, and interviews with WordPerfect users who took the challenge. Also in the kit are the files you need to test Word on your own. Call (800) 323-3577, Department Y76. We think once you judge for yourself, you'll want to take advantage of our special $129 upgrade offer.* Then, no doubt, you'll end up spreading the word for us.

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Inside

PC MagNet was designed to provide added value for you. But little did we know how much it would benefit us over the years. Through MagNet, we tap into the knowledge and opinions of a pool of highly technical and eloquently spoken readers. Via MagNet introductions, some of our best readers become some of our best writers and editors.

The latest MagNet match brings us Sheryl Canter, associate editor for our applications development team. First, Canter began writing for our Productivity section in addition to her regular job as a statistician. Eventually she became—and still is—sysop on PC MagNet's programming forum. With her participation, the traffic on the programming forum quickly grew from 20 to as many as 200 messages a day.

When she's not fueling discussions on MagNet's programming forum, Sheryl Canter is associate editor for our applications development team.

When the glut of new development products on the market led us to spawn a new team devoted to programming languages, development tools, operating systems, and databases, Canter was a natural to lead it.

In her brief stint as associate editor, Canter has investigated the inner workings of Microsoft Windows and OS/2 and has pitted Xbase development systems in a head-to-head face-off. In this issue, she tackles visual development environments. "We worked long and hard simply to come up with a definition of visual development environments we could all agree on," says Canter.

Her background as a C programmer and her concept of what visual development environments should offer stimulated an active dialog between writers and editorial staff throughout the review process. "It's a very exciting new category," comments Canter. "More powerful computers inspire more powerful software, and object-oriented, event-driven programming techniques have emerged to deal with the increasing complexity. Visual development environments built on this paradigm are an obvious next step." Our testing indicates that despite their appeal, these applications often fall short when it comes to complex projects. But Canter is convinced that this is "only the infancy of visual development."

Picking up on the visual development theme, the Productivity section takes an in-depth look at Microsoft Visual Basic programming. And elsewhere in this issue, the theme is equally visual. The graphics team shows you how image-capture utilities take on new meanings when run under Windows. And as for the blazing speed that visual environments require, don't forget to take a look at our reviews of the first batch of 486/50 PCs.

—Robin Raskin ■

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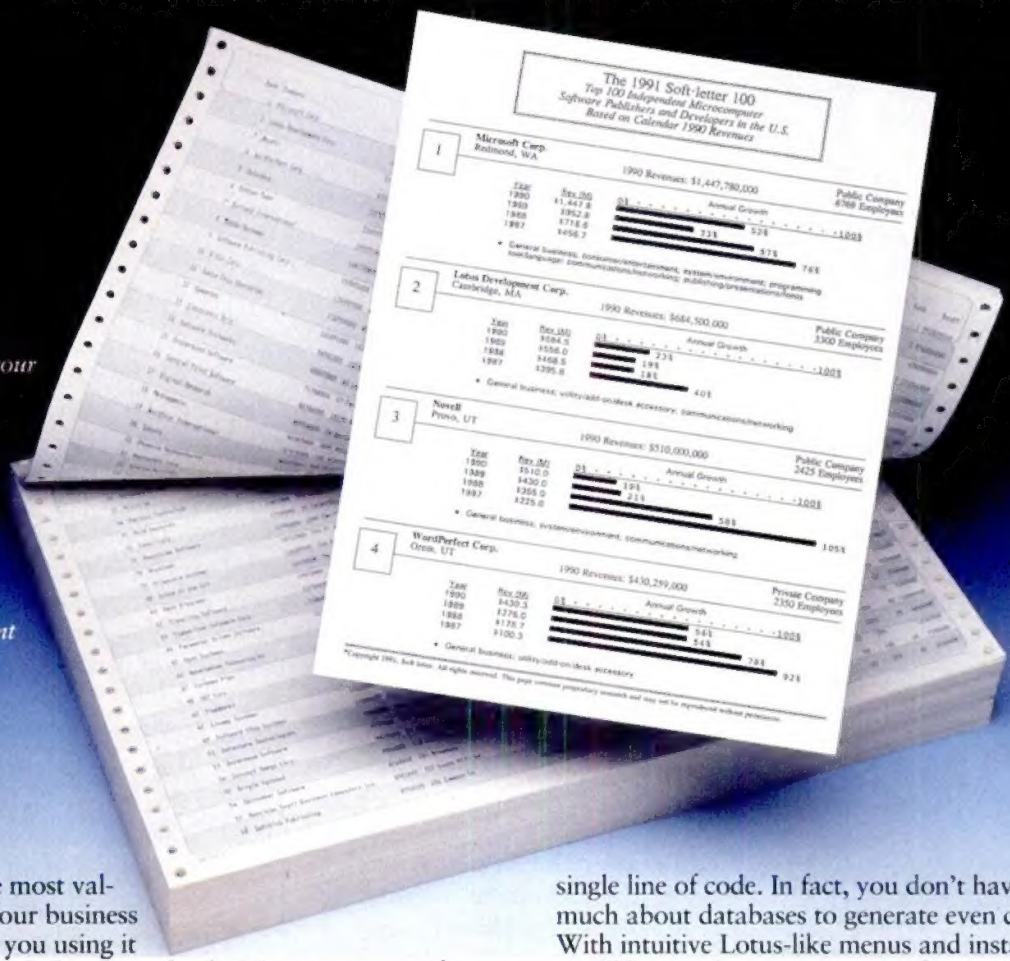

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Hauppauge announces an end

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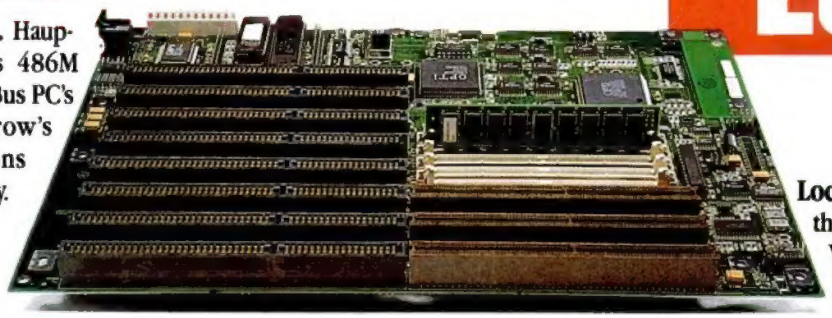

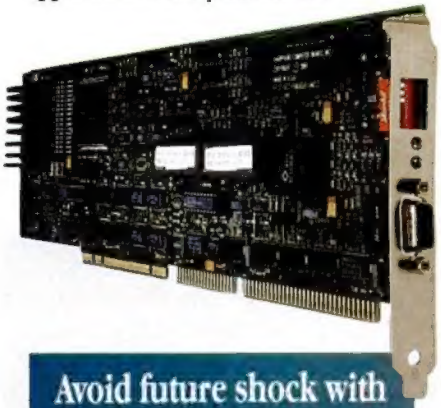

Avoid future shock with Hauppauge CPU modules

Full throttle graphics. Designed by our engineers and built here in the U.S.A., our 486M PC's are for Windows users who need more performance at an affordable price. And for users who have seen the dizzying change in technology and don't want to buy a new computer every two years. We know you don't want to replace your computer every time a new trend develops.

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The Modular LocalBus improves PC performance

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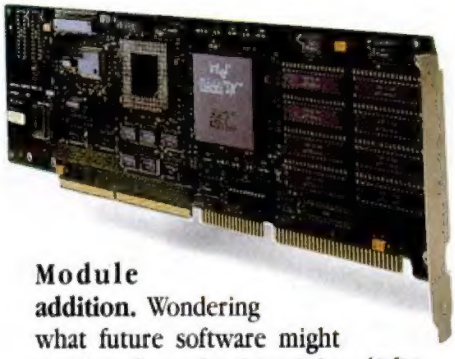
Module upgrade. As new generations of CPU chips come to market, CPU upgrade will not always be possible. The Hauppauge LocalBus is designed as a 64-bit bus to allow upgrades to future CPU generations with maximum performance.



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Local

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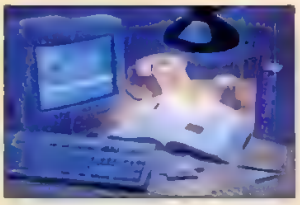

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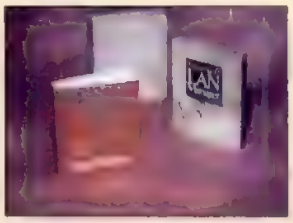

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Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, longer bars indicate faster products (higher throughput rates). Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25e's.

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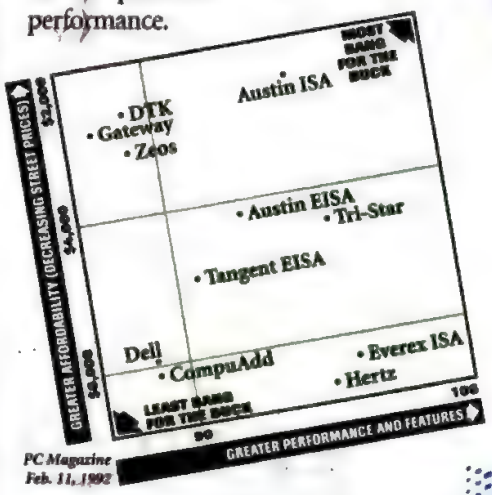

PC Magazine Feb. 11, 1992

The performance/features axis of this chart is based on ten data points: the four benchmark test scores, installed RAM, disk capacity, VGA RAM, free slots, drive bays and extras—miscellaneous items such as free bundled software, mouse, on-site service, FCC Class B certification, extended warranty policy and flash EEPROM. A set of weighting factors has been applied to the raw numbers; you can find this data in the Software Library of PC Magazine's Editorial Forum as 01BANG.WRI.

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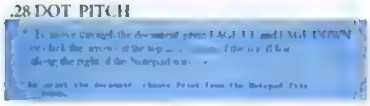

.39 DOT PITCH

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286/12.5 U.S. 1989
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2MB RAM to 16MB	2MB RAM to 16MB	4MB RAM to 8MB	4MB RAM to 32MB	4MB RAM to 32MB
40MB Hard Drive	80MB Hard Drive	80MB Hard Drive	120MB Hard Drive	120MB Hard Drive
14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 1024x768 Color Monitor w/512K Video RAM	14" VGA 1024x768 Non Interlaced Color Monitor w/1MB Video RAM	14" VGA 1024x768 Non Interlaced Color Monitor w/1Mb Video RAM	14" VGA 1024x768 Non Interlaced Color Monitor w/1MB Video RAM
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard
DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse
Small Footprint Chassis	Small Footprint Chassis	Small Footprint Chassis	Small Footprint Chassis	Small Footprint Chassis
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486/33 EISA WinTower	486/DX2-50 WinStation	486/50 ISA WinStation	486/50 EISA WinTower	386/SX25 Notebook
Intel 486 running at 33MHz w/64K Cache to 256K	Intel 486 running at 50MHz w/64K Cache to 256K	Intel 486 running at 50MHz w/256K Cache	Intel 486 running at 50MHz w/256K Cache	386SX running at 25MHz
8MB RAM to 64MB	8MB RAM to 32MB	8MB RAM to 32MB	8MB RAM to 64MB	1MB RAM 2.4-5MB
120MB Hard Drive	210MB Hard Drive	210MB Hard Drive	210MB Hard Drive	60MB Hard Drive
TTL Monochrome Monitor	14" VGA 1024x768 Non-Interlaced Color Monitor w/1MB Video RAM	14" VGA 1024x768 Non-Interlaced Color Monitor w/1Mb Video RAM	TTL Monochrome Monitor	10" VGA LCD Display, 640x480 w/32 gray scale
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB Floppy Drive
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	80-Key Keyboard
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	Optional DOS 5.0 Windows 3.1
Tower Chassis	Small Footprint Chassis	Small Footprint Chassis	Tower Chassis	6.31 hrs with battery
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CIRCLE 360 ON READER SERVICE CARD

Letters

ABOUT THAT VIRUS

On page 30 of *PC Magazine* (Trends, March 31, 1992), you suggest twice that not calling a bulletin board is one way to avoid catching a computer virus. As the chart on page 31 of the same issue shows, the vast majority of computer virus infections are passed via floppy disk. Boot-sector viruses like Stoned and Michelangelo are almost four times as common as file infectors, such as Jerusalem B. Boot-sector viruses can't be passed via modem.

Most bulletin boards, like mine (PCBOARD), come with automated routines to scan and reject uploads pending the result of the scan. Where are you guys getting your information?

BBSs provide information and fixes for contaminants like Michelangelo. By remaining active on a local BBS, one can stay aware of these problems when they occur; receive free, expert advice on how to deal with them; and download software that will detect and kill viruses. Calling a BBS, for those of us who do so regularly, is our protection against viruses.

Peter Wadsworth
Sysop, Coconino County BBS
San Francisco, California

Shame on you for telling people to avoid bulletin boards! Nobody gets viruses from BBSs anymore, at least not from respectable ones. The comment is an insult to sysops (system operators) everywhere (and by the way, I am not a sysop).

Viruses are DTDs—Diskette-Transmitted Diseases—pure and simple. There is no way to arrive at statistics, but the probability of getting a virus from a respectable BBS is so near to zero that there is no way to compare it with the number of viruses you can contract from commercial software and from new and used hardware. But like some human viruses, you are most likely to get it from a "friend."

Bob Stephan
Pebble Beach, California

Michelangelo's legacy: The latest virus scare inadvertently gave bulletin boards a bad reputation.

PC Magazine regrets that it suggested avoiding bulletin boards as one way to prevent viruses from infecting our readers' PCs. We acknowledge the many useful services that bulletin boards provide to the personal computing community, and we plead guilty to running a bulletin board ourselves, namely PC MagNet.—*Ed.*

CALLER BEWARE

This is in reference to John C. Dvorak's positive appraisal of Caller ID (Inside Track, December 31, 1991) and Mr. William Robinson's negative response (Letters, March 31, 1992). Mr. Dvorak is mostly correct in stating that it will "virtually eliminate crank calls and stop anonymous harassment," and Mr. Robinson is mostly wrong in responding that Caller ID is virtually worthless because the caller can prevent his number from being displayed at the called party's phone by dialing a code.

When someone calls me on the phone, they are invading my privacy; I am not invading theirs. The solution to the federal privacy law regarding Caller ID is simple. If a caller has dialed a code to prevent me from knowing who it is, I won't pick up the phone. Voila! No crank calls or anonymous harassment.

So, crank callers and anonymous harassers, beware: If you want to speak with me, you *will* display your phone number on my Caller ID.

John E. Johnson, Jr.
Redwood City, California

I expect that Caller ID boxes will eventually come with options that will prevent a phone from ringing if no number or a "nonselected" number is coming in. In these cases, I will simply let my recorder take the message. In the rare case that there's an emergency, an operator can put the call through. Caller ID certainly does give phone owners the ability to screen their calls.

Edward Gallup
Sonora, California

A HAPPY PROGRAMMER

I was genuinely thrilled to see Douglas Bolings' Lab Notes article "How New Memory Designs Keep Pace with New Processors" (March 31, 1992). I especially enjoy all the Lab Notes articles, but this one topped them all. He dealt with complicated material, but kept it on a level people can understand even if they don't have an electrical engineering degree. Keep up the good work!

Andrew Carlson
St. Louis, Missouri

NO CHOICE FLOPPY DISKS

Jeers to *PC Magazine* for not following its own advice and for ignoring the needs of its readers. In John C. Dvorak's February 25, 1992, column ("The Dead-End Trend"), he stated, "The fact that most software is still distributed on 5.25-inch 360K disks is ridiculous. If all vendors distributed their software on 3.5-inch disks, the 5.25-inch drive would be gone overnight."

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CIRCLE 105 ON READER SERVICE CARD

Letters

I just received my copy of the *PC Magazine* utility disk set—on 5.25-inch 360K disks. My PS/2 doesn't have a 5.25-inch disk drive, so I was forced to resort to copying the utilities on my old XT clone. It does not bother me so much that the utilities came on this medium—millions of PCs still have those drives—but I was never given a choice. Come on, *PC Magazine*! If the very publication that is calling for the abandonment of this disk format cannot do so itself, how can you expect the industry to do it?

Matt Beal
South Pasadena, California

TALKING TAXES

I just had to write to you about "Tax Software Gets Better with Age" (February 25, 1992). In reviewing these packages, you used two households featuring a simple and a complex scenario. The simple one used a family of four, two wage earners, gross income of $15,000, and had only some child-care credits. The complex one used a married couple who had taxable wages of $175,000 and lots of other incomes and deductions.

> Here's the 64-nanosecond question: How come I can write off my tax preparer's fee, but I can't deduct the price of a simple $29.95 tax software package?

My problem with these two scenarios is this: A family of four that makes only 15 grand probably isn't going to own a computer, much less worry about spending a hundred bucks on a tax program that will get used once. More than likely, they would rather use that hundred to put food on the table and clothing on their kids' backs. And a married couple with wages of $175,000 is more than likely to use an accountant/tax attorney, and they don't have the time nor the inclination to sit down at the computer to try and figure out their own taxes.

Bruce C. Gubser
Papillion, Nebraska

Here's the 64-nanosecond question: How come I can write off my tax preparer's fee, but I can't deduct the price of a simple $29.95 tax software package? The 19-millisecond answer: CPAs have a far better congressional lobby than do software developers.

Kevin Kilpatrick
Williamsburg, Virginia

A SMALL WISH

Please show a diagram of the keyboard when you review portable computers. Since these computers frequently complement desktop computers, commonality of keyboard configuration is an important consideration.

John Ploch
Alexandria, Virginia

DON'T FORGET THE NON-WINDOWS C PROGRAMMERS

I know you guys get caught up in all the latest trends, and you probably have a lot of fun with it. There's really nothing wrong with that in itself. The problem, though, is that I am a novice Turbo C programmer who uses a 286 PC under DOS 3.3, not a 486 under Windows. It's been ages since I've seen an application in your programming department's column where I didn't need at least Windows 3.0 or a 386 or 486 PC. Why are you so machine- or product-specific all of the time in programming? All I'm asking is that you don't forget those of us without big corporate budgets.

Michael J. Rocco
West Mifflin, Pennsylvania

SCSI IS THE WAY

I'm puzzled by the enthusiasm in the press (Connectivity column, February 11, 1992) for the new Enhanced Parallel Port (EPP). It seems to me that another interface is just about the last thing we need, particularly since an EPP is no better than a standard parallel port unless you have a printer or other device that also has an EPP—products that don't yet exist. Even more important, there is an existing, well-defined and well-supported interface that is far superior to EPP—SCSI. What we really need are more products (printers, network adapters, and the like) with SCSI interfaces. I wouldn't

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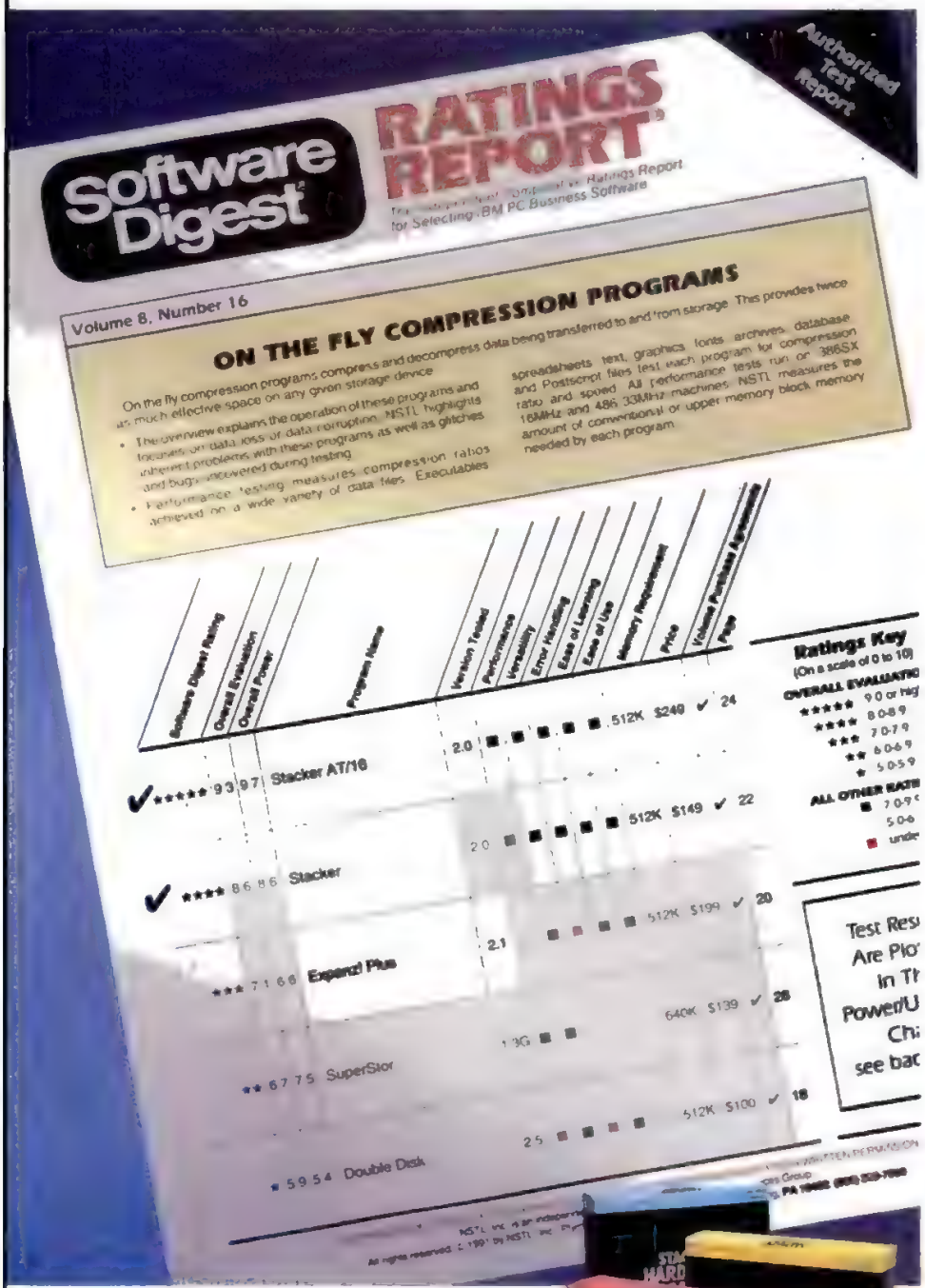

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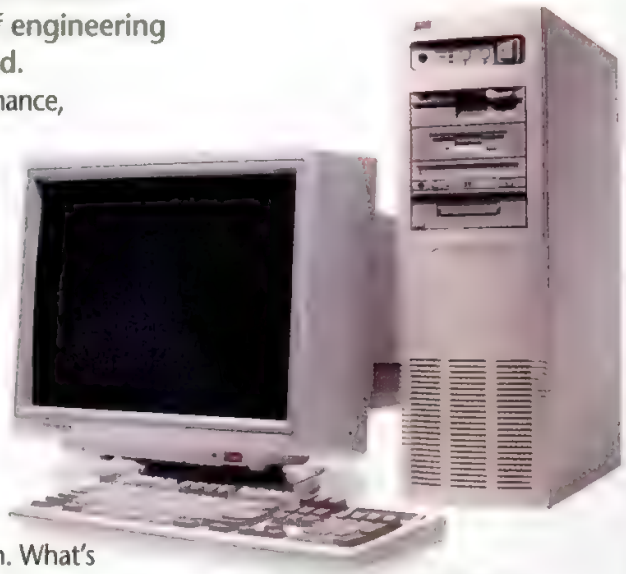

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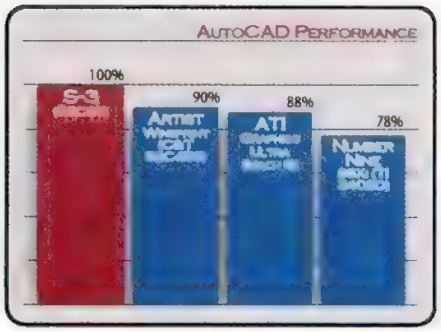

In PC Magazine's latest comparison of video chip performance tests running AutoCAD, the S3 based accelerators outperformed the competition, including the ATI Graphics Ultra, in all 10 categories except redraw where the TI 34020 took the lead.
Graph based on AutoCAD performance test results PC Magazine 3-17-91.

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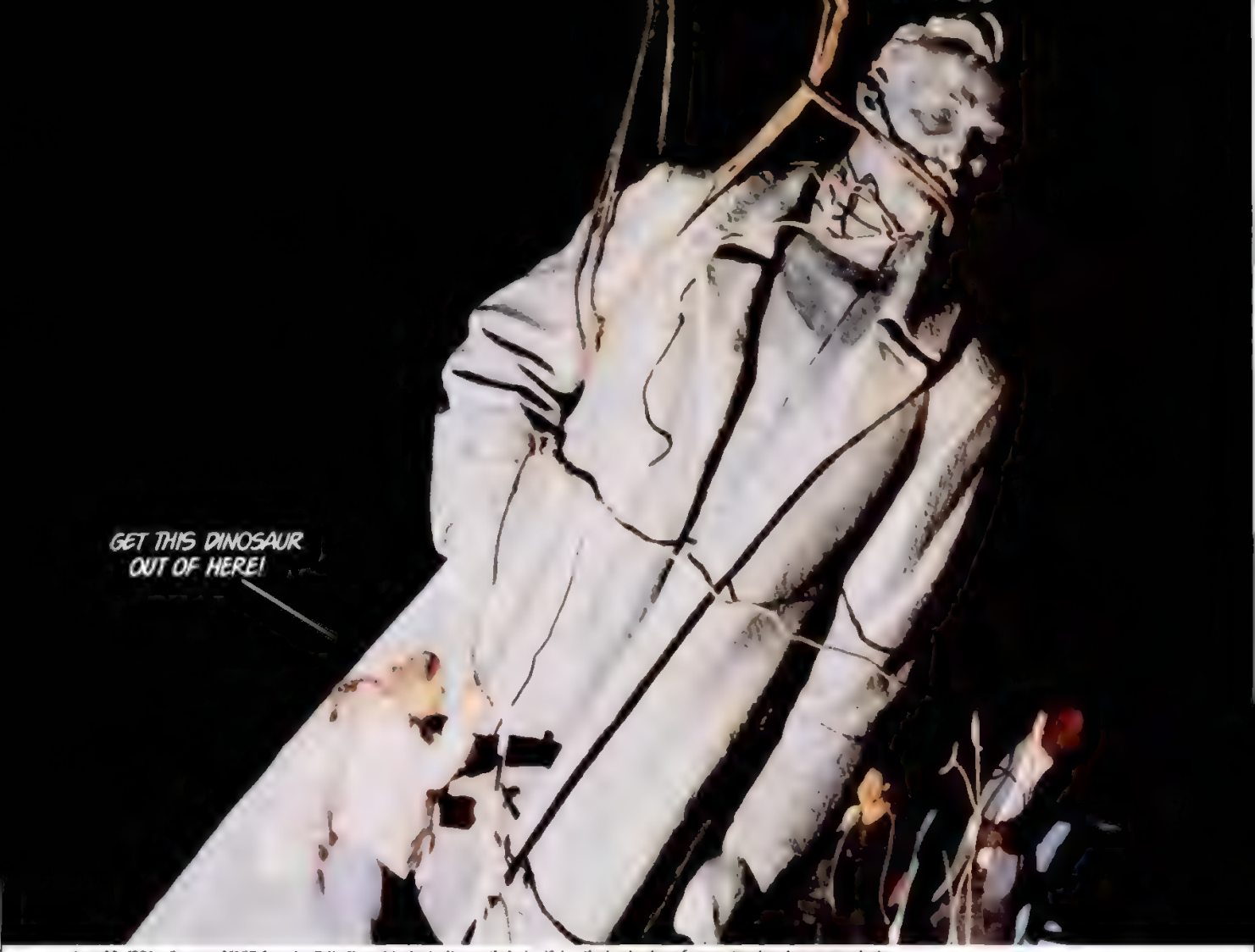

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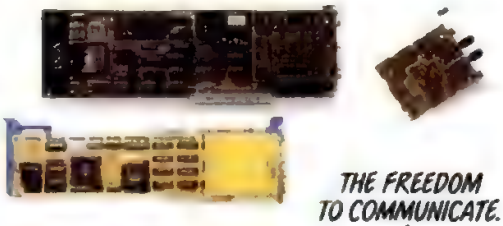

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John Navas II
Dublin, California

THREE HAPPY CUSTOMERS

I just wanted to mention my satisfaction with one firm: FastTrax International. I bought *FastTrax* (a *PC Magazine* Editors' Choice) two years ago for my 100MB drive with DOS 4.01. I was very satisfied with the way *FastTrax* worked to defragment and reorganize my disk.

Recently, my drive crashed and I had to replace it with a 131MB drive with DOS 5.0. About then I saw a letter in *PC Magazine* that said you could upgrade *FastTrax* for $25. I called the company's new Bridgeway number and was first told no upgrade was available, and then I was told an upgrade would be sent to me after I supplied my VISA info. After over two months I received neither the upgrade nor the VISA charge. At that point I called and left my complaint on the company's answering machine.

To my surprise, that same night, Mark Elfield, the author of *FastTrax* and now the new owner, called me to apologize. He promised to send me a free upgrade right away and he apologized again, even though he was in no way responsible (Bridgeway was distributing the product, not Elfield). True to his word, I received my free, registered copy a few days later. Needless to say, I was very impressed and I thought it was worth mentioning that what we have here is a superb product with an author who stands behind it.

Sheldon Hoffman
Woodmere, New York

Recently I received, unsolicited, a package from Intuit called Quicken Customer Care Kit. The package contained the improvements the company has made to *Quicken for Windows*, along with questions and answers and tips. In addition, I found two disks for *Quicken for Windows* 1.01.

While most companies are charging $10 or $15 for updates, Intuit is sending them at absolutely no cost, and *without* waiting for a request from the user. I hope all the software companies out there take note of this.

Naras Iyengar
Plano, Texas

I received a coupon from the folks at Alpha Four to get their *Alpha Four* software with a free ZIP code program. Right after I placed the order, I got another coupon from them, this one offering *Home Lawyer* and *Managing Your Money* free with *Alpha Four*. I was not happy with myself and called them to vent my frustration. I was amazed to hear that if I sent in the new coupon I could receive the free software.

However, a month went by and I still hadn't received the additional free software. I called a company representative and was told they would look into it and get back to me. They got back to me the same day and said that somehow my order had slipped through the cracks but it would be shipped out that night. The next day the free software was waiting for me! They had shipped it air express.

Alpha Four obviously went much further than they had to. Alpha Four is certainly a company I would deal with again. And by the way, *Alpha Four* is a great program as well: extremely user-friendly. Hmmm...what a concept: great product, great service. Too bad all companies aren't like that.

Gerald M. Hoots
Columbia, Maryland

CORRECTIONS & AMPLIFICATIONS

In the sidebar "Multimedia Titles: Growing by the Dozen," (Multimedia cover story, March 31, 1992) we should have stated that Syracuse Language Systems' products cost $89.95 each.

In the sidebar "Display-List Drivers: Moving Around AutoCAD in Real Time," from the feature "19 Programs That Build on AutoCAD," February 11, 1992, the correct address and phone numbers for Video Seven are 46221 Landing Pkwy., Fremont, CA 94538; 800-238-0101, 510-623-7857.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments and suggestions. Please send correspondence to Letters, *PC Magazine*, One Park Ave., New York, NY 10016, or upload it to PC MagNet (see page 10 for access information). All letters become the property of *PC Magazine* and are subject to editing. ■

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Trends

Trends & Technology Shaping the Personal Computer Market

Fast Inroads for Cyrix 486 Hybrid Chip

Cyrix Corp.'s new 486-compatible microprocessor will let PC makers sell 486 systems at 386 prices. Almost as soon as the new chip was announced in April, systems manufacturers began developing inexpensive 486 systems based on Cyrix's technology—despite some compatibility questions and pending legal issues.

The 25-MHz Cx486SLC is a hybrid, the rough equivalent of crossing Intel's 486SX with its 386SX. Like the 486SX, the Cyrix chip uses the 486 instruction set and doesn't have a math coprocessor. Like the 386SX, it operates at 32 bits internally and 16 bits externally to the bus.

The Cyrix chip, though, has some crucial limitations that may slow its acceptance. Its on-chip cache is only 1K, while the Intel 486 has an 8K cache, and the Cx486SLC uses proprietary 486 microcode instead of Intel's, which raises questions about compatibility.

Still, the Cyrix chip is attractive to a lot of vendors. It costs about the same as Intel's 25-MHz 386SL and less than half as much as Intel's 25-MHz 486SX. More important, the Cx486SLC is pin-compatible with Intel's 386SX, which means PC vendors can put it into current sys-

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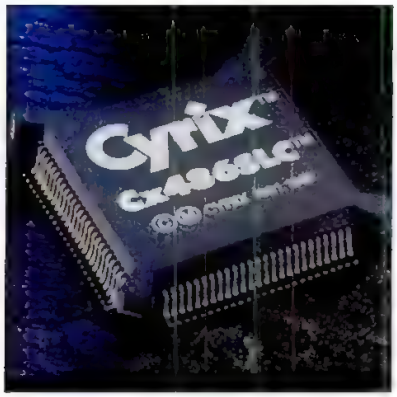


Cyrix's new chip is less than half the price of Intel's 25-MHz 486SX.

Photo-Quality Color Printers Get Cheaper

Color printers using thermal wax transfer technology have become increasingly affordable over the past three years, dropping from $10,000 to under $7,000. But their dye diffusion thermal transfer (D^2T^2) siblings, which produce prints approaching the quality of color photos, have remained in the $15,000 to $40,000 range. This year, D^2T^2 printer prices are finally dropping to the neighborhood of the cheaper wax printers—some as low as $11,000.

Wax and D^2T^2 engines both use the thermal transfer process. Both heat the ribbon to place a dot on the paper, but D^2T^2 engines can adjust the temperature levels, enabling them to produce millions of hues for continuous-tone prints that look like original photographs.

Both printer types use some of the same engine parts. Until recently, those parts had been very expensive, largely because of low volume. But as the market for color wax printers grows (nearly 30,000 units shipped last year, according to InfoCorp), economies of scale are bringing down the price of parts for both wax and D^2T^2 printers.

Falling prices for memory are also helping to lower color printing costs. While a black-and-white laser printer requires 1MB to store a graphics page, a wax printer needs 4MB, and a D^2T^2 needs about 32MB per page. But new developments (JPEG compression, among them) are letting them get away with 16MB.

GCC Technologies, Mitsubishi, RasterOps, and Sony all sell 300-dpi D^2T^2 printers in the $11,000 range. Tektronix is also expected to enter this tier. (Kodak and JVC are still selling pricier models.) Unlike their predecessors (which lacked standard printer drivers), the new D^2T^2 printers will come with PostScript Level 2.—*Oliver Rist*

Ink jet printers make up most of the color market. But as thermal wax transfer and dye diffusion thermal transfer (D^2T^2) printer prices come down, their market acceptance is likely to grow.

Source: InfoCorp.

Windows Printing to Get Faster

Windows 3.1's printer drivers have brought some much-needed speed to printing, but serious breakthroughs in speed await the same kind of performance boost that video got last year. Printers, add-in boards, and cartridges that understand the operating system's graphics functions will arrive as early as this summer.

One reason Windows printing has been so slow is that the operating system uses one graphics imaging model (the Graphics Device Interface, or GDI), and laser printers use another (a page description language, usually HP PCL or PostScript). The printer driver wastes a lot of time trying to translate between the two models. The obvious solution is to get the printer to understand Windows' GDI calls—just like today's video accelerators have graphics functions (bit-block transfers, or BitBlts, for instance) built into the hardware.

The idea has some roots Microsoft may want to forget. A couple of years ago, the company was advocating printers with OS/2 Presentation Manager's Graphics Programming Interface (GPI) calls built in. But Microsoft couldn't endorse the same approach for Windows at the time because the GDI wasn't

Pipeline

by Gus Venditto

Now, AMD Looks Over Its Shoulder

Last year, when Advanced Micro Devices' 386 line was introduced, Intel's market position was so strong that the competition didn't hurt it very much. While Intel may have lost out on some windfall profits, AMD's real impact was to expand the PC market and hasten Intel's broadening of the 486 family with the 486SX and 486DX-2.

This time, as both Chips & Technologies and Cyrix introduce Intel-compatible processors, the circumstances are different. In this round, someone's got to get hurt.

When AMD entered the market, Intel was not meeting the demand for 386 chips and dozens of small system vendors eagerly bought from AMD. In effect, AMD leveled the playing field, since it put 386 chips into the hands of people who had been on Intel's waiting list. PC prices came down because the smallest PC makers were able to compete.

One reason that Intel survived AMD's new line relatively unscathed was that manufacturers who made their name for being aggressive had become conservative.

Off the record, some of those companies will tell you that they can't afford to risk losing access to Intel's tech support. Nor do they want to lose the fringe benefits of being in favor with Intel, such as the six-figure payments some received for altering their 486 motherboard designs to accommodate the SX–to–DX-2 upgrade socket. Of course, Intel's greatest selling point is its technology leadership, and any company that prizes its own ability to stay at the front of the technology curve fears being at the bottom of Intel's distribution list for new parts.

AMD, on the other hand, has no way to hold the loyalties of PC manufacturers. Only a few of AMD's best customers will even use AMD's name in ads that loudly promote the 40-MHz chip. In fact, even now some companies run ads that call the AM386/40 an Intel product.

That C&T and Cyrix will succeed is far from assured. Their new products still have to survive court challenges, and they'll have to be competitive with AMD. Right now, though, both are generating strong interest.

The real wildcard, however, is IBM. It has created the 486 SLC, a technique for doubling and tripling the speed of the 486 internally. IBM has a license from Intel that allows it to make the chip and sell it, just as long as the chip is on a board.

It's not clear which of these second sources will survive the heat of battle. What you can bet on is that Intel will be coming out with the 586 seconds after anyone gains significant market share, and that could be very soon.

Gus Venditto is a contributing editor to PC Magazine *and the editor of* PC Sources.

ILLUSTRATIONS: SUSAN NEES

sophisticated enough and it lacked a scalable outline font engine. Now that the GDI has matured and TrueType is in place, a more direct relationship between Windows and printers makes sense.

Apple is already ahead in this game. The company's LaserWriter IIF and IIG, announced last fall, already have the TrueType rasterizer built into ROM, and the new Personal LaserWriter NTR has both TrueType and Adobe PostScript (Level 1) in ROM. Another printer vendor at the forefront of Windows printing is LaserMaster Technologies, whose WinJet/800 add-in board for the PC processes GDI calls directly from Windows apps and prints the files on an HP LaserJet. And don't be surprised if Microsoft gets into the cartridge business or if HP's next printer has built-in GDI calls.

While most printers are getting smarter, some (like LaserMaster's WinPrinter) are getting dumber, leaving the GDI processing to the PC's CPU. And that's where a fast, smart parallel port fits in. Lots of people are working on improving the parallel port: Xircom and Zenith Data Systems' Enhanced Parallel Port boosts the average transfer rate by 400 percent (See Trends, January 14, 1992). And two competing parallel port specs for bidirectional communication (which would let a printer tell you, for instance, that it's out of paper) are on the table: one from Hewlett-Packard (which seems to have Microsoft's seal of approval), and the other from the Network Printer Alliance, which includes Adaptec, Destiny Technology, Insight Development, Intel, Lexmark, Okidata, Ricoh, Tektronix, and Texas Instruments.

Microsoft's ultimate goal is that Windows, rather than an LCD panel, will be the interface to your printer.

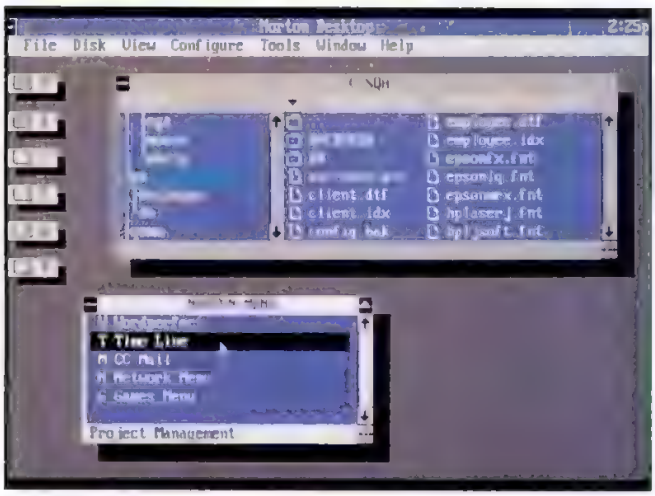
—*Mary Kathleen Flynn*

Look Out, Windows—DOS Apps Live!

After all the fanfare Windows and OS/2 have gotten, you might think that character-mode DOS Application development has drawn its last breath. Think again: Application development for DOS is thriving because DOS apps still outsell Windows apps three to one, according to the Software Publishers' Association. But DOS apps are getting more Windows-like in functionality.

Character-based applications, also known as text-based apps, are often faster than their Windows- or OS/2-based counterparts because they aren't constrained by the graphical overhead. This speed lends itself to programs that use the CPU for operations unrelated to the screen output, such as file compression and number-crunching, spell-checking, and indexing. In addition, DOS apps often require less RAM and storage memory than their Windows counterparts.

Symantec, which recently upgraded *The Norton Desktop for Windows* (the latest is Version 2.0, see First Looks), also released *The Norton Desktop for DOS* (*NDD*). *NDD* has a Windows-like interface and uses the same menus and keystrokes as the Windows version. *NDD*'s file manager provides drag-and-drop capabilities similar to the Windows version, but it requires only 512K of RAM to operate. Symantec, which has Windows, Macintosh, and DOS products, plans to continue develop-



***The Norton Desktop for DOS* has the same menus and keystrokes as the Windows version.**

ing applications for DOS.

Borland, a company that is very much committed to Windows and OS/2 development, has recently shipped DOS-based versions of *dBASE*, which it acquired in its Ashton-Tate takeover last summer, and *Quattro Pro*. While a Windows version is still in the wings, *Quattro Pro* 4.0 can be run on an XT-class PC with 512K of RAM. With 640K you can run it in WYSIWYG mode, which makes it look and feel a lot like a Windows app.

Lotus has both a short- and long-term strategy for its *1-2-3* for DOS. In the 2.*x* series, the development house recently announced an upgrade to Version 2.4, and the 3.*x* series will get an upgrade this summer. Lotus plans major revisions to both lines in 1993. According to Larry Roshfeld, Lotus's product manager for DOS spreadsheets, "The growth rate for DOS applications is not as large as the rate for Windows, but the size of the market is enormous."

Since DOS is the lowest common denominator—with 82 million users—most software houses have a DOS strategy, and no one wants to ignore the huge installed base. For example, while WordStar has introduced a Windows version of its word processor, it recently shipped Release 7.0 of the DOS version. And don't be surprised to see new DOS versions of *Microsoft Word* and *WordPerfect*—because folks, DOS ain't dead.

—*Christopher Barr*

The Greening Of the Toner Cartridge

More and more hardware vendors are launching recycling programs for consumable supplies. Printer companies are taking the lead as they begin to recycle—and even remanufacture—laser printer toner cartridges.

Canon engines, which are found in many laser printers including Hewlett-Packard's LaserJets, have long been praised for combining an organic photoconductor (OPC) drum, toner, and developer into one easily replaceable part. Although they are more convenient than three-part photoconductor systems, the single-part systems still have to be replaced as frequently. For example, the cartridge used in the HP LaserJet III, which is based on the Canon SX engine, is rated at 4,000 pages. That means a new cartridge every three months or so, according to BIS Strategic Decisions, which estimates that the typical desktop laser user prints 1,200 pages each month. So what do you do with the old cartridge?

John Shane, an analyst at the Norwell, Massachusetts, market research firm, points out that environmentally conscious users have many options for recycling. You can sell old cartridges to supply companies for $7 to $10 a cartridge. These companies—Nashua, GNC (formerly General Ribbon), Nu-Kote, and PM Co., to name a few—remanufacture the old cartridges and resell them for around $60 apiece, compared with street prices of $75 to $90 for new cartridges, says Shane. Some printer vendors, such as Dataproducts and Qume Peripherals, remanufacture their own cartridges, paying up to $10 for an old one. And some retailers, such as Staples, offer $5 rebates for used cartridges, which they sell to remanufacturers.

Some printer vendors, most notably Canon and HP, frown on remanufacturing, citing quality concerns. Both companies, however, encourage customers to send them used cartridges so that the raw materials can be recycled. They pay for the shipping costs and make a donation of $1 per cartridge to environmental organizations. Last fall, Lexmark International, which makes the IBM LaserPrinters, launched a similar program. The company pays for shipping and lets a local nonprofit organization handle the recycling, including reaping the profits from selling the raw materials, approximately 70 percent of which are recyclable. (Lexmark, in fact, hangs on to the rest in hopes of finding an organization that can reuse it.)

Kyocera International may have the best approach to the environment issue. The company has applied its renowned ceramics technology to laser printers. Kyocera proposes to do away with the disposable cartridge altogether—by developing a new photoconductor technology that lasts as long as the printer. The photoconductor system in Kyocera's new LED, 10-page-per-minute Ecosys aSi FS-1500A printer is rated at 300,000 pages, or more than 20 years of average use. The company is the first to deliver a personal printer

Top 15 Software Sellers at Retail

Current Ranking		Last Issue
1	**Microsoft Windows 3.1 Upgrade** Microsoft Corp.	-
2	**Microsoft Windows 3.1** Microsoft Corp.	-
3	**ProComm Plus 2.0** Datastorm Technologies	5
4	**Quicken for Windows** Intuit	-
5	**Microsoft DOS 5.0 Upgrade Kit** Microsoft Corp.	1
6	**WordPerfect 5.1 for DOS** WordPerfect Corp.	6
7	**QEMM-386 6.0** Quarterdeck Office Systems	2
8	**Stacker 2.0** Stac Electronics Inc.	4
9	**Calendar Creator Plus 4.0** Power Up Software	-
10	**Prodigy Start Up Kit 3.1** Prodigy Services Co.	-
11	**Quicken 5.0** Intuit	3
12	**Word for Windows 2.0 Upgrade** Microsoft Corp.	-
13	**Labels Unlimited 3.0** Power Up Software	-
14	**Word for Windows 2.0** Microsoft Corp.	-
15	**DR DOS 6.0** Digital Research	12

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending April 3, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market.

Sales information compiled by Ingram-Micro.

BRIEFS

■ **High Standards:** As the world becomes more multinational, PC users in the U.S. are sure to benefit from a new series of tough European business standards. The International Standards Organization (ISO) 9001 Standard evaluates product and service quality through a procedural review of a company's entire operations, including product design, manufacturing, and testing. "ISO 9001 registration is becoming a de facto prerequisite for doing business in Europe," says Bill Shlosser, director of business development at UDS Motorola, one of the first U.S. companies to get 9001 registration.

■ **Soft Modems:** Digicom Systems expects to be the first to deliver a modem that can be upgraded through software. Using Analog Devices' multimedia digital signal processor (see Trends, May 26, 1992), the modem card will start with V.32bis and Group III send and receive fax capabilities; software upgrades for voice messaging and binary file transfer will be available later. Digicom will sell the card to add-in board makers and systems vendors; end user products costing under $200 should start to show up in July.

■ **Video Parallel Port:** While several companies are focusing on speeding up the parallel port and giving it bidirectional communications (See "Windows Printing to Get Faster," page 29), LaserMaster is turning it into a video port. The company's card, which had not been priced at press time, plugs into the parallel port and gives it a high-speed video mode, which speeds up printing when used with LaserMaster's *WinPrint* software.

■ **Apples at Sears:** Apple Computer is finding new ways to distribute its products. Sears will begin selling three Macintosh models as well as the PowerBook 140 portable. All will come with modems and *ClarisWorks* integrated software.

—*Mary Kathleen Flynn*

with an amorphous silicon drum, previously found only in copiers. The drum uses a thin-film deposition coating, which creates a surface that is more durable than the OPC coating.

Although you'll probably never have to replace the Ecosys printer's drum, you will have to refill its ceramic microfine toner every 5,000 pages, or roughly once every four months. The printer comes packaged in calp, a plastic Kyocera calls "environmentally sensitive" because it doesn't emit toxic fumes when burned. Perhaps best of all, the new toner costs only $39, yielding a cost per page of less than one eighth of one cent, compared with the average of two to three cents per page of most laser printers.

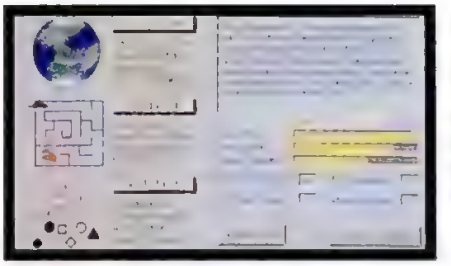
—*Mary Kathleen Flynn*

It's Not a Virus, It's Artificial Life

The lines between computer science and biology are beginning to blur with a new technology called artificial life. Using genetic algorithms, developers are writing programs in which creatures evolve and develop their own intelligence.

Although artificial life was first developed on massive supercomputers, Maxis, of *SimCity* fame, plans to release two artificial life programs for PCs by the end of the year. The first, *SimLife*, uses artificial life to create an ecosystem where the disparate flora and fauna thrive or die, based on the player's decisions. The second program, called *ElFish*, lets you create new forms of sea life.

SimLife uses artificial life algorithms to alter the genetic makeup of the life forms. Using what Maxis calls "computational ecology," both plants and animals change and evolve depending on environmental, chemical, and genetic factors.



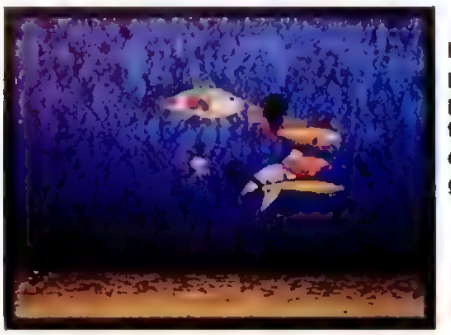
With *SimLife*, you're in control of the ecosystem, and your decisions can lead to life or death.

ElFish, short for electronic fish, is an artificial-life program being developed by a team of programmers who emigrated from Russia. The team, led by Vladimir Pokhilko and Alexei Pajitnov (the inventor of *Tetris*), is comprised of biologists and programmers who had been working with genetic algorithms in Moscow since 1989.

Although they first experimented with flowers and butterflies, the scientists settled on fish because of their beauty. *ElFish* lets you build computer-generated fish and a fish tank for them to swim in. After you've selected the parents, the computer generates the offspring based on the parents' gene pool. You can then mate those fish to create realistic-looking fish that exist only on your monitor.

During the "gestation period," *ElFish* generates bitmaps by combining graphics and the parents' genetics. Using models based on the scientists' genetic and biological research, the new fish inherit certain characteristics from their parents, but they develop their own unique identities. Since the fish are patterned after live fish, their swimming movements are surprisingly lifelike.

—*Christopher Barr*



In *ElFish*, you pick the fishes' parents and the software evolves future generations.

Cyrix Chip

CONTINUED FROM PAGE 29

tems by making only minor changes to the system board.

Zeos will be one of the first to ship a machine with a Cyrix chip. The company is installing the chip in its 20-MHz 386SX notebook and modifying the motherboard to exploit the chip's cache. The result is a 25-MHz Cx486SLC notebook with a 100MB hard disk and 4MB of RAM that Zeos will sell for around $2,000.

A consortium of U.S. notebook component makers plans to use the Cyrix chip in its designs. The group, whose members include Western Digital Corp. and Lexmark International, showed a prototype notebook based on the Cyrix chip at Spring Comdex in Chicago. CompuAdd Express is expected to be the first to use the consortium's Cyrix-based notebook design.

Northgate plans to release desktop systems based on the Cyrix chip this summer. "We're still committed to the Intel 386SL for notebooks," said Art Lazare, Northgate's CEO. "But the Cyrix chip is a viable option to the 386SX. It gives more power at a lower cost."

Cyrix, known previously for its math coprocessors, plans to increase the CPU product line. The 25-MHz Cx486SLC is the first in a series of 486-compatible chips, with a 33-MHz version due later this year.

While the low price point makes this hybrid attractive, Cyrix has a few hurdles to leap. Before its CPU is broadly accepted, Cyrix will have to resolve the patent infringement lawsuit Intel filed over the new chip. And the company will have to prove to PC makers that a non-Intel microcode chip is 100 percent 486-compatible.

—*Christopher Barr* ■

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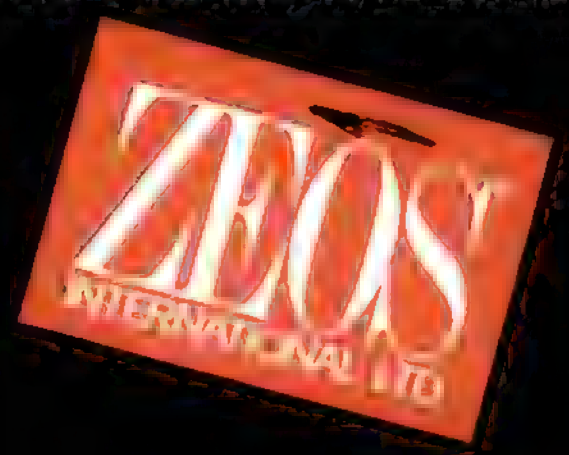

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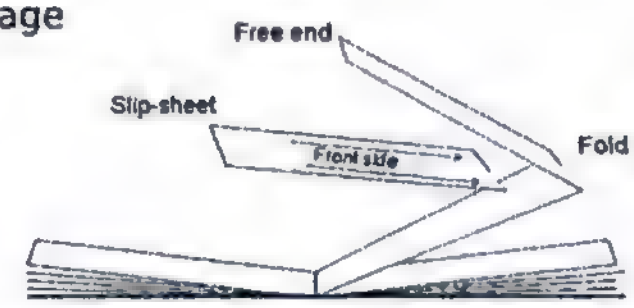

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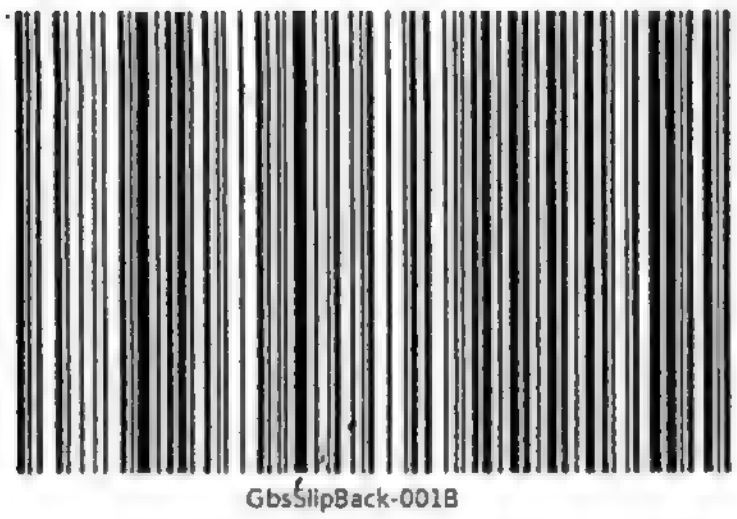

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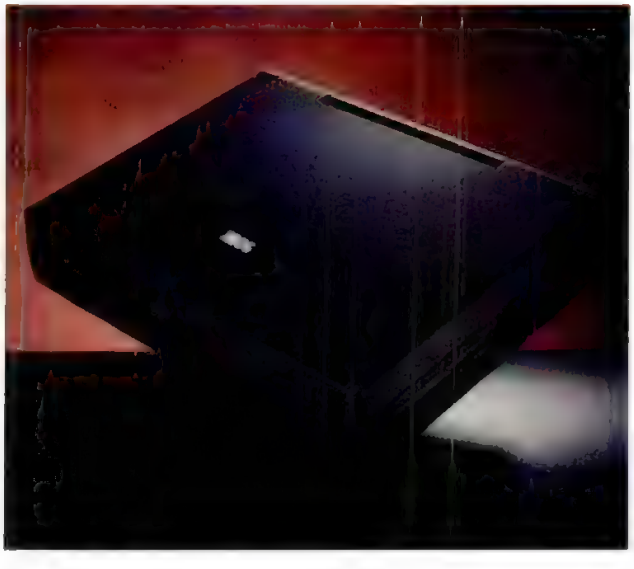

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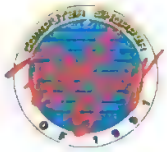

So Do Notebook Users.

Source: PC World survey of customers who own Notebooks, January, 1992.

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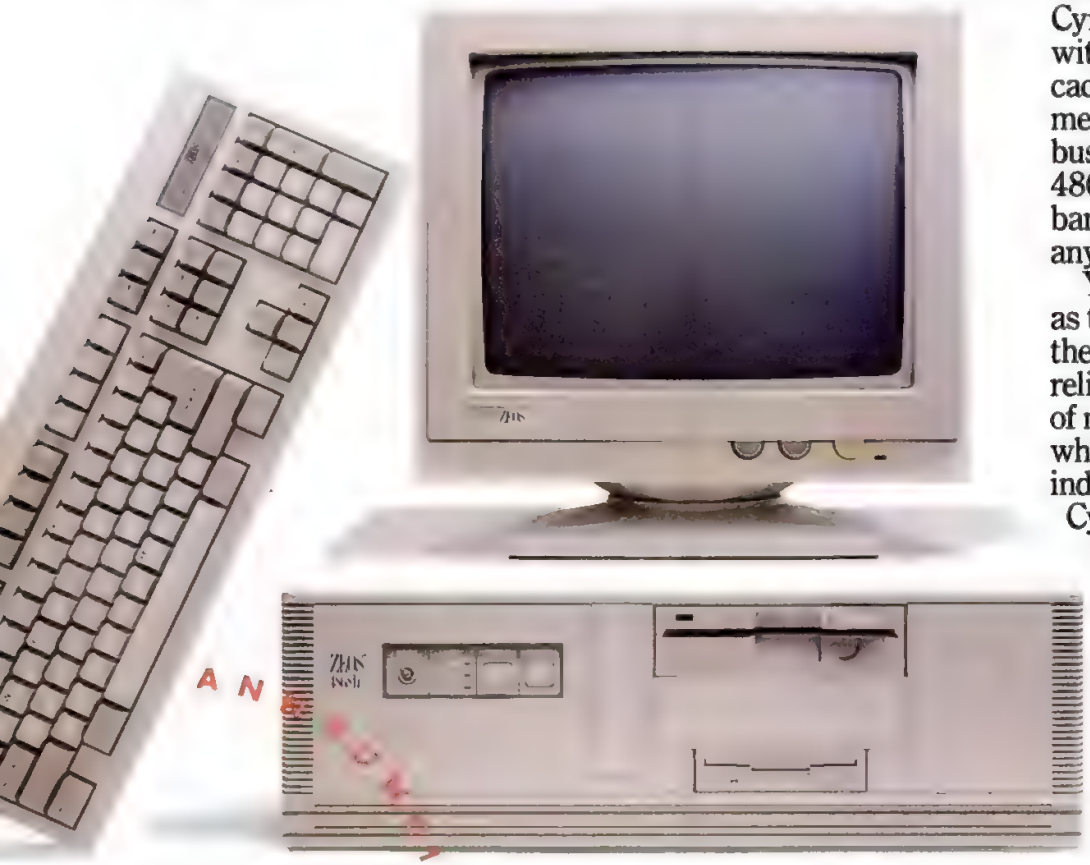

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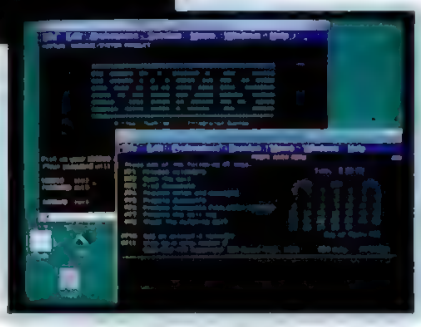

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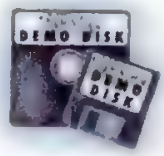

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CIRCLE 270 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

Quarterdeck's DESQview/X: Another GUI Multitasker, But This One Talks to Unix

HANDS-ON
by Kevin Christian

DESQview/X is a new multitasking graphical user interface from Quarterdeck Office Systems, the innovative developer of the original *DESQview* environment and also the developer of the widely used *QEMM* memory management products. In essence, *DESQview/X* is *DESQview* along with the graphics and network savvy of the X Window system. The new X Window technology gives *DESQview/X* exciting capabilities, such as complete and direct control of applications running on remote DOS or Unix workstations.

The $275 *DESQview/X* has several features that make it an enticing $100 upgrade for current *DESQview* users. First, *DESQview/X* is a highly configurable environment. It's a snap to create new *DESQview/X* menus and link the menu choices to the applications you run or to simple macro scripts.

The other attraction for *DESQview* users is *DESQview/X*'s graphical orientation. Using scalable font technology, DOS application windows can be displayed in their entirety, large or small. On high-resolution monitors, this useful feature lets you have several DOS sessions fully visible and executing concurrently.

Many *DESQview* users will not want to move to *DESQview/X*, however. Because of its graphics, *DESQview/X* operates much less crisply than character-mode *DESQview*. As always, adding graphics has its price in increased system overhead. If you need the networking features of *DESQview/X* but don't have a high-end machine, you might want to stick with *DESQview*, which should soon be enhanced to have much of the same communication magic as *DESQview/X*.

DESQview/X's multitasking graphical interface is highly customizable, and both DOS and Windows apps can run in partial-screen windows. Among the open apps here are *Manifest* and *QEMM-386*, both of which are included.

Newcomers to *DESQview* will find that *DESQview/X* is an exemplary DOS multitasker. *DESQview/X* supports both a traditional window, which means that some of the application is hidden as you shrink the window, or a scalable window, which means that the text is drawn exactly the right size to ensure that the whole application is always visible. Scalable DOS windows are just the thing for DOS power users who want to juggle several applications simultaneously. *DESQview/X* also supports Microsoft Windows 3.0 and 3.1, which means you can tap the power of *DESQview/X* without abandoning all your shiny new Windows applications.

REMOTE EXECUTION

The more interesting part of *DESQview/X* is its networking

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Want to Control Your PC by Fax? PaperWorks Is a Start

HANDS-ON
by Christopher Hunt

PaperWorks wouldn't be interesting were it simply a powerful new fax software program that lets you fax documents from your PC to a fax machine. The important innovation in this new product from the XSoft division of Xerox is that it lets you remotely control your PC from any fax machine by using paper forms that you fax back to your home system, instructing that PC, if it is equipped with a fax board, to send documents to whomever or wherever you would like.

The $249.95 *PaperWorks* is the latest brainchild to come from Xerox's legendary Palo Alto Research Center (PARC). PARC is responsible for such computer innovations as the mouse, laser printers, Ethernet, and the graphical user interface, to name just a few. The technology pioneered in *PaperWorks* is "smart paper," which allows hieroglyphic-type markings on a paper form to control your PC.

The hardware demands of this new technology are high. You'll need to run Windows in 386 Enhanced mode with 4MB of free RAM and an additional 6MB of virtual RAM provided by the Windows swapfile. We encountered numerous snags operating

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DESQview/X

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flair. Like implementations of the X Window system on Unix workstations, *DESQview/X* assigns a central role to the network. X allows applications to execute locally using the local display, or to execute on a remote system while using the local display.

This feature is fully supported by *DESQview/X*. You can run a spreadsheet on a coworker's machine without leaving your desk and without interrupting your coworker's work. This is not simply accessing a file remotely, it is true remote execution. An application can run on someone else's machine, but use your display, keyboard, and mouse. Conversely, an application can execute on your machine but be controlled from some other machine, and that machine can be a Unix workstation.

The innovation here, and it is truly a considerable achievement, is to bring X Window technology to the DOS world in a way that makes sense to DOS veterans. *DESQview/X* doesn't ask you to abandon DOS; rather, it extends DOS by enhancing the power of the network. Remote execution isn't likely to be the norm for single-user productivity applications, but there are many other applications that are group-oriented, and they'll benefit greatly from the implementation of *DESQview/X*.

MANY IMPLICATIONS

There are many implications to *DESQview/X*'s new bag of tricks, and one is that using *DESQview/X* raises a host of new security concerns. Fortunately, *DESQview/X* is configurable to allow or disallow many of its network capabilities, and it is optionally password-protected. But this technology has many subtle security considerations, and you should tread carefully.

On the more positive side, widespread use of *DESQview/X* could create a small industry for developers who want to design enterprise applications that take advantage of the system's unique and powerful networking capabilities.

UTILITIES INCLUDED

The standard $275 *DESQview/X* package includes *QEMM-386* and the *Manifest* system reporting tool. It also includes a copy of *Adobe Type Manager* (for management of scalable Type-1 fonts for X Windows applications), an icon-based program manager, and a file manager. The standard package also includes drivers that allow *DESQview* to interact with NetBIOS or *NetWare* network protocols.

The X Window system doesn't specify anything about the user interface, how menus are activated, and the like. Instead, X implementations must provide a window manager, which implements an overall look and feel. *DESQview/X* contains its own window manager, which gives the system a subtle three-dimensional look and feel. Though the style is easy to adapt to, Quarterdeck also supplies the more workstation-standard Motif and Open Look window managers. These packages are sold separately for $250 and $200, respectively.

POWERFUL DEVELOPER'S PLATFORM

Besides being a powerful platform for multitasking DOS and Windows applications, *DESQview/X* is also a powerful developer's platform. It has a built-in DOS extender from Rational Systems, which makes it easier for developers to port large X applications. X lacks the wealth of personal productivity applications that run under DOS and Windows, but X does support many important vertical and specialty applications that can now operate on a PC. *DESQview/X* developer's kits will soon be available from Quarterdeck for each of the three supported window managers.

With *DESQview/X*, Quarterdeck is making a fundamental statement that the DOS market is now ready for the next step in networking. Until now, DOS users have had a choice between file server networking, exemplified by Novell's *NetWare*, and peer-to-peer networking, pioneered by Artisoft's *LANtastic*. Both of these approaches have focused on file sharing, which is only one of many possible network functions. *DESQview/X* proves that much more sophisticated network control is readily accessible to today's installed base of desktop systems.

Novell, Microsoft, and IBM are all thinking about how to take more advantage of the network. With *DESQview/X* and its remote execution, you can make that step today. ■

WHAT IS X?

The X Window System is a graphical windowing system that is widely used on Unix workstations. The central idea of X is that applications, which are called *clients*, interact with graphics servers using a strictly defined graphics protocol. This allows both client and server to be on a single machine or on separate machines linked together by a network.

For example, a massive simulation of the Earth's climate could run on a supercomputer, using a workstation for its graphical display.

Another X innovation is to separate the core windowing features—such as control of a region of the screen—from the user interface features. X itself doesn't specify a user interface; it leaves that chore to window managers, which are X programs that implement a particular style of user interface. The two standard window managers are OSF's Motif and Sun's Open Look.—*KC*

FACT FILE

DESQview/X
Quarterdeck Office Systems Inc., 150 Pico Blvd., Santa Monica, CA 90405; 800-354-3222, 310-392-9851.
List Price: $275; upgrade, $100. Support for TCP/IP networks, $200; OSF Motif window manager, $250; Open Look window manager, $200.
Requires: 4MB RAM, 10MB hard disk space, DOS 3.0 or later, mouse.
In Short: An exciting graphical user interface that does traditional *DESQview* multitasking but also lets DOS systems and Unix machines talk on the same network and execute applications remotely across the network.

CIRCLE 438 ON READER SERVICE CARD

***DESQview/X*'s Icon Editor and on-line help. The inclusion of *Adobe Type Manager* makes scalable DOS windows possible.**

***DESQview/X*'s File Manager application can manage and run files on both local and remote systems. It's truly distributed computing.**

PaperWorks

CONTINUED FROM PAGE 37

with only 8MB free, and Xerox recommends you have 12MB of free memory for best performance. The actual sending and receiving of the faxes is accomplished with either Intel's SatisFAXtion, The Complete PC's Complete Fax or Complete Communicator, or the CEI ProFAX board.

Using Windows' PostScript driver, *PaperWorks* can fax documents created in *Microsoft Word for Windows*, Versions 1.*x* and 2.0, and *Microsoft Excel* 3.0. (We had difficulty faxing some documents created in *Excel* 4.0.) *PaperWorks* also works with *WordPerfect* 5.1 and can fax ASCII text files and black-and-white .PCX files. Unlike other Windows fax software like *FAXit* or *WinFax Pro*, *PaperWorks* doesn't operate while you're in the word processor or spreadsheet application. Instead, you have to establish named documents in the *PaperWorks* file system.

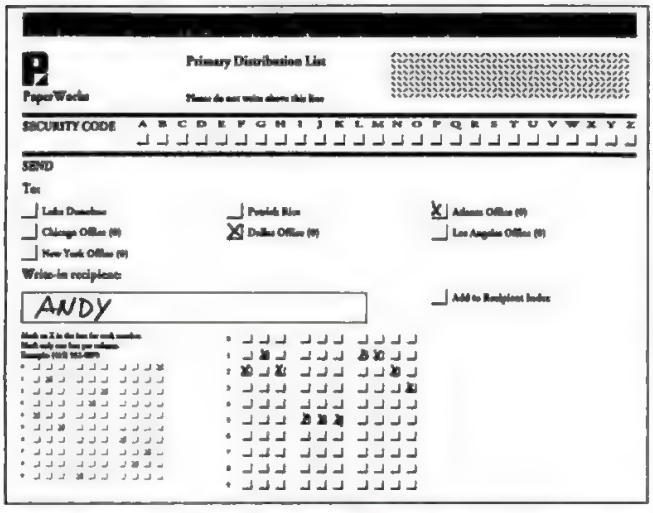
While *PaperWorks* can be used to fax documents from within Windows, it's also a forms generator, an image processor, and a database. You can create custom forms and send faxes directly from your PC, or from a distance (by faxing the form back to the PC from a remote fax machine). *PaperWorks* receives faxes and processes them in a proprietary image format that can be viewed, printed, and saved out to a .PCX file. *PaperWorks* keeps a database of incoming and outgoing documents and can store and file incoming faxes.

DESKTOP METAPHOR

PaperWorks operates with a desktop metaphor. Before you use *PaperWorks* from a remote site you have to know which documents you'll want access to while you're away. You then drag them from the file window to the document window on the desktop. *PaperWorks* is smart enough to know if it can read the format of the document and rejects files it doesn't know. Documents can be used singly, or you can group multiple documents with different file types in categories you create. For instance, you can set up a Price List document group and place ASCII text files as well as *Word* .DOC and *Excel* .XLS documents in it.

After you've established the documents, you create an address book of fax addresses. You can use single addresses or nest multiple addresses within distribution lists.

Then comes the part that shows off *PaperWorks*' strength: the forms. Forms essentially accomplish five tasks. You use them to send documents, to store documents that you've faxed to your PC, to retrieve documents or faxes that are on your PC, to delete documents and forms you no longer need, and to fax from your PC the contents of your distribution lists.



This form is one of several that *PaperWorks* generates for you to use on the road. The hieroglyphics at the upper right contain encoded instructions for the home PC, and simple check marks send faxes on their way automatically.

***PaperWorks* uses a desktop metaphor to help you keep track of the files you fax. It also maintains a fax log.**

The forms are generated and printed from your PC. For instance, using a template supplied by *PaperWorks*, you can make a form that sends updated price lists to different field offices. As you edit the form on-screen, *PaperWorks* adds check boxes and document names that you can fill in when you're on the road. You take the form with you on your trip, and when you fax the form back to your *PaperWorks* PC from your hotel's fax machine, the program faxes the documents you specified to the addresses you marked.

If you forget to take any forms with you, you simply fax a blank sheet of paper to *PaperWorks* and it faxes back a multipurpose form to let you access your files. Forms can be secured by using a code that makes the forms password-protected.

The top right of the form contains the hieroglyphic-type markings. These are *PaperWorks* instructions that tell the PC whom to send faxes to, which documents to send, what to store or delete, and where the files are located. *PaperWorks* is the first product from Xerox in the *PaperWare* product line. Future *PaperWare* products still in development will utilize the same kind of markings.

ROOM FOR IMPROVEMENT

While the concept of *PaperWorks* is brilliant, the execution needs more polish. For one thing, *PaperWorks* is a memory hog—if you don't have 10MB of free memory, it just won't work. The installation missed a few adjustments that we were able to correct after reading the manuals, but the on-line help is very sparse.

The desktop metaphor can get tedious. Instead of directly acting on an object, forms and documents must be dragged to the action tray before you can print them.

PaperWorks isn't the product you want if all you need to do is fax from Windows; we'd recommend *WinFax Pro* for that. It also isn't the product you might dream of having: true remote-control computing, for any application and any task, via fax. As its name implies, *PaperWorks* is mainly a document handler. But who knows? Improved remote control may be the next logical step for the program to take.

For now, if you travel and constantly instruct your home office to fax *WordPerfect-*, *Excel-*, or *Word for Windows*– generated documents to your hotel or to clients, *PaperWorks* gives you the invaluable power of easy remote-control faxing. ■

FACT FILE

***PaperWorks*, Version 1.0**
XSoft Business Division of Xerox Corp., 3400 Hillview Dr., Palo Alto, CA 94304: 800-626-6775.
List Price: $249.95.
Requires: 4MB RAM, 20MB hard disk space, Microsoft Windows 3.0 or later, SatisFAXtion, The Complete Fax, The Complete Communicator, or CEI ProFAX fax board.
In Short: *PaperWorks* gives you the ability to fax documents to and from your fax board-equipped PC from a remote fax machine by using specially encoded forms.
CIRCLE 436 ON READER SERVICE CARD

Norton Desktop for Windows Speeds Up, Adds Robust Editor

HANDS ON
by Barry Simon

Symantec's *Norton Desktop for Windows* has established itself as the leading replacement for Windows' Program and File Managers. Competing packages either define themselves in terms of *Norton Desktop* or make sure that they work with it. Version 2.0 of the $149 package is a successful upgrade.

Most of the components of the product have been enhanced, and there are several new modules including an editor, virus protection, a macro recorder, and a financial calculator.

The central element of the collection is the *Norton Desktop* itself, a combined file-launcher and manipulator. Symantec has addressed the most frequent complaint about this module: slow loading times. While our tests didn't match the "up to six times faster" claims of Symantec, the effect was still dramatic. On our 25-MHz 386 test system, *Norton Desktop* 1.0 took 20 seconds to load under Windows 3.0 and 15 seconds under Windows 3.1. Loading Version 2.0 running under Windows 3.1 took only 7 seconds. The time Windows takes to load is not included in these results.

Norton's Quick Access, part of the *Desktop*, had the look of Program Manager in Version 1.0 but included enhancements such as subfolders. Version 2.0 lets you choose one of three looks: the Program Manager look, a scrolling text list, or an icon-only toolbox.

Also new to the basic desktop are drag-and-drop capabilities, and not just for the few *Norton*-specific programs supported in Version 1.0.

There are also several improvements to the file manipulator. The side-by-side directory tree and file lists are still there, but now you can easily get the total size of all the files in a directory—a capability that was lacking in Version 1.0.

A popular feature of the file view is the button bar, which lets you call up file actions from text buttons. Version 1.0 allowed only six buttons; Version 2.0 can have up to 14 (depending on your display type).

IMPROVED FILE VIEWING

The file viewers have also been improved. Support has been added for almost 20 new file types including .DRW, 24-bit TIFF, and *Lotus 1-2-3*, Release 3.0, files. Most graphics, word processor, database, and spreadsheet file types are included (two exceptions are .PIF and Targa). The ZIP viewer shows only the zip directory, not the files within. Lotus's *Magellan*, a DOS product, has been doing this for years, but no Windows program has this feature.

The file viewers worked well, with two exceptions. Some *Microsoft Word for Windows* 2.0 files we tried to view generated error messages, and the .PCX viewer failed on 24-bit color .PCXs and a few 8-bit .PCX files.

Sleeper, the included screen saver, has been improved. It will use the screen savers that come with Windows 3.1 as well as those that ship with *Intermission* and with *AfterDark* 1.0.

Batch Runner, the batch language that Symantec licenses from Wilson Windoware, has several enhancements in this version. Network-specific commands have been added, the batch editor has been improved, and, most significantly, there is now a Macro Builder to record batch files. But there is still no dialog editor.

Missing from the initial shipment of Version 2.0 is support for tape drives in the included *Norton Backup for Windows*. This is promised, and a coupon is provided to get the tape backup module for a nominal shipping charge when it becomes available.

NEW EDITOR

Of the new modules, the best is Desktop Editor, a vast improvement over Notepad. It will edit multiple files using the Windows MDI, has a powerful search feature including pattern matching, and offers a multilevel undo. It also includes a great file-comparison feature.

A financial calculator to supplement the tape and scientific calculators is also new. Using reverse Polish notation, it will do cash flow analysis and statistics on entered data. In addition, there are fill-in-the-blank forms for simple interest, mortgage amortization, bond yield, and date/time arithmetic.

Also new with this version is virus protection that includes everything in the standalone *Norton Anti-Virus* program: a DOS device driver and both Windows- and DOS-based scanners.

There is an uninstall module, something we wish other Windows programs provided. And the incompatibility with Turbo Pascal for Windows programs has been resolved.

Any regular user of *Norton Desktop for Windows* will want to upgrade, for the faster loading and the useful editor if nothing else. What was already a good alternative to the basic Windows interface has become even more attractive. ■

Groups in *Norton Desktop* can show up as tool boxes, as text lists, or as they would in Windows' Program Manager.

***Norton Desktop*'s file viewer can show (clockwise from upper left) .GIF files, icon libraries, .WMF files, 24-bit TIFF files, .DRW files, and .WK1 files.**

FACT FILE

***Norton Desktop for Windows*, Version 2.0**
Symantec Corp., 10201 Torre Rd., Cupertino, CA 95014; 800-441-7234, 408-252-3570.
List Price: $149; upgrade, $49.
Requires: 2MB RAM (3MB recommended), 9MB hard disk space, Microsoft Windows 3.0 or later.
In Short: The leading Windows desktop replacement has gotten better with enhanced performance, a strong file editor, and several new additions.

CIRCLE 423 ON READER SERVICE CARD

There was a time when we all worked **QMS-PS 1700** *individually. We each had a computer and we each had a printer. Today, many of us work in groups. We choose our computers for their ability to perform well within networks. Shouldn't the same criterion now apply to our printers?*

How to Spot the True Network Printer Among a Host of Imitators.

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Unlike most printers that merely claim to be appropriate for network applications, the QMS-PS® 1700 was conceived and built to be the most efficient printer there is in a network environment. In terms of cost, as well as performance.

Proprietary software that resides within a 25 MHz RISC controller is what sets this printer apart from all others.

It handles PostScript® documents up to six times faster than the more common 68020 microprocessor. And it's the heart of an architecture you'll find in printers that come from QMS and only QMS. We call it Crown.

Consider whether its benefits would help your group work even more efficiently.

The QMS-PS 1700 recognizes incoming data and selects the right printer language without troublesome software reconfigurations.

The QMS-PS 1700 connects to Ethernet® networks configured as DECnet®, TCP/IP, NetWare®, or EtherTalk™ protocols or to Token Ring configured to support the NetWare protocol. And it can be shared between multiple computers with different operating systems.

Its input buffers spool jobs so that host applications aren't hung up waiting for files to print.

The input capacity of the QMS-PS 1700 is 1,000 sheets. Output is 500. And there's an optional duplexer for two sided work.

What's more, if a job is interrupted for any reason, this printer has the intelligence to reprint any needed pages and then continue.

Its context switching capability preserves "states," such as fonts and macros, when switching between emulations so you don't waste time downloading them each time.

Font or emulation storage can be expanded with optional internal and external SCSI hard drives.

So the QMS-PS 1700 is much more than a laser printer. In fact, it's exactly what most work groups need but haven't been able to find. Until now. The QMS-PS 1700 is The Network Printer.

The Rom card gives control over the

the LAN administrator printer's settings.

	QMS-PS 1700	HP IIIsi
Both 300 and 600 DPI resolution	✔	
Concurrent interfacing	✔	
Spooling	✔	
Context switching	✔	
Security system	✔	

You could compare the QMS-PS 1700 to the HP III Si, but there really is no comparison

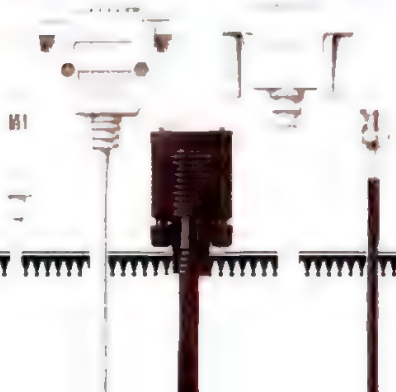
Multi-res lets you switch between the exceptional output of 600 dpi and the speedier 300 dpi resolution.

Crown architecture. Proprietary hardware and software design that make our printers The Network Printers.

The QMS-PS 1700 printed this file in 62 seconds.

The competition took 180 seconds. We're almost 3 times as fast.

Simultaneous Interface Operation, or SIO, lets the printer work over all its interfaces at once.



QMS

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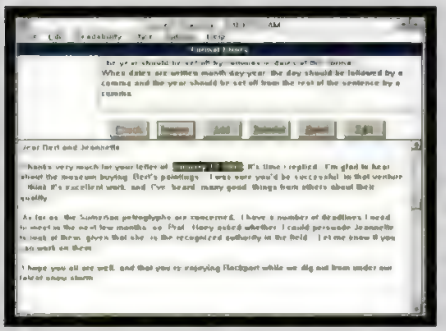
CIRCLE 141 ON READER SERVICE CARD

New Windows Grammar Checkers Improve Error-Catching Rates

HANDS ON
By Robin Raiomowitz

No matter how good a grammar checker is, it does not guarantee that your document will end up error free. The complexities of the English language pose formidable challenges for programmers, and grammar checkers are still some distance from achieving the reliability of spelling programs. Nevertheless, good grammar-checking programs, such as *Correct Grammar for Windows* and *Grammatik 5 for Windows*, continue to get better at detecting more kinds of errors.



After detecting an error, *Correct Grammar for Windows* offers options for correcting it, editing your document, and learning about the relevant stylistic rules.

CORRECT GRAMMAR FOR WINDOWS

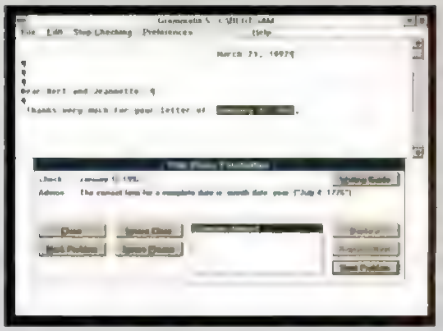
Correct Grammar for Windows, Version 2.0 ($119), from WordStar International, is a sharp program. It's easy to use; has a logical, attractive interface; and like some rival packages, offers the convenience of letting you check spelling and grammar simultaneously. Its documentation is clear, and its advice for correcting errors is helpful and authoritative.

Correct Grammar can proof text in the Windows Clipboard and in documents created by many DOS and Windows applications. If you work with one of the popular Windows word processors, you'll be able to integrate *Correct Grammar* so you can perform grammar checks without exiting from your word processor.

While it has fallen a little behind *Grammatik 5*, *Correct Grammar for Windows* performed respectably on our grammar-checking tests, scoring 35 percent for detecting errors in grammar and punctuation, 90 percent for detecting errors in spelling, and a good 4 percent for false flagging (finding nonexistent errors; lower percentages reflect better performance in false flagging).

One good feature in *Correct Grammar* is its assignment of more than half the screen to a display of your document (*Grammatik 5* lets you see less of the text surrounding an error). Like *Grammatik 5*, *Correct Grammar* offers many choices of rule settings for working with different styles of writing. Both programs permit you to suppress a style rule for a single session or permanently, make it easy to edit your text on-screen, and offer readability statistics. For some errors, these programs offer alternative phrasings that you can paste into your document with a few mouse clicks.

Interestingly, *Grammatik 5* and *Correct Grammar* also share some similar disadvantages. While they let you go back to recheck a sentence after the first pass, they keep only enough text in their memory buffers to give quick access to about half a page of your document; trying to move beyond that limit can be time-consuming. Another common flaw is that neither program's editing mode can handle underlining.



Grammatik 5 for Windows boasts a clean interface and intelligently designed controls for detecting stylistic errors and determining how to avoid them.

Correct Grammar for Windows has other minor drawbacks. Working with the user dictionary is more complicated than need be. The program can't display a sentence's parts of speech, a useful feature for students and one that's included in *Grammatik 5* and *RightWriter*. *Correct Grammar*'s Ignore 1X button, which permits you to pass by an error once, isn't always displayed; this leads to confusion between its function and that of the program's Ignore button.

Correct Grammar's only major flaw is one it shares with other grammar checkers: The best they can deliver is half a loaf. Certainly you'll be grateful that they've spotted many of your errors, but you won't be absolutely certain they've found them all.

GRAMMATIK 5 FOR WINDOWS

When *PC Magazine* evaluated writing tools last year ("Write on Target: 15 Writers' Tools," September 24, 1991), *PowerEdit*'s 45 percent score on our grammar-checking test was the highest in its group—a score that won it Editors' Choice. On the same tests, *Grammatik IV*'s score of 26 percent put it in third place.

Now there's a new contender. The recently released *Grammatik 5 for Windows* ($99), from Reference Software International, is more powerful than its predecessors: It racked up a score of 53 percent on our grammar test. This makes it the first grammar checker that will usually find a majority of the errors in a typical document. *Grammatik 5* also boasts a very acceptable 3 percent rate for false flagging. The *Grammatik 5* test results were the same for the DOS and Windows versions of the program.

Doubtless, these scores are attributable to Mor-Proof, the new parsing engine that Reference Software developed for grammar checking and spelling veri-

CONTINUES ON PAGE 44

WHAT'S THE GOOD WORD? Ask Random House

In the past, electronic dictionaries were too small to rival desk dictionaries. But Reference Software's $99 *Random House Webster's College Dictionary & Thesaurus* breaks the mold: It includes all of the entries in the recently published *Random House Webster's College Dictionary* together with a 275,000-synonym electronic thesaurus.

Along with definitions, *Random House Webster's* gives you grammatical information, pronunciation guides, etymologies, and usage notes. It comes with an anagram generator, a wildcard search routine, and, unlike other dictionary programs, a database containing 11,000 biographical and geographical listings. The program is easy to use, and a TSR mode permits hotkey operation from inside word processors.

Aside from the monumental (and monumentally expensive) *Oxford English Dictionary* on CD-ROM, it's the best electronic dictionary available.—*RR*

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Four great Windows™ products from Lotus®–Freelance Graphics,™ AmiPro,™ 1-2-3® and cc:Mail™–now at a great price.

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Grammar

CONTINUED FROM PAGE 42

fication. A good spell-checker can boost a grammar program's hit rate: It helps in detecting such stylistic errors as neologisms, improper verb formations, and missing apostrophes in contractions.

At the heart of Mor·Proof is a 100,000-word dictionary based not on individual terms, but on morphemes (root words). Coded into each dictionary listing is a series of attributes, such as whether a verb will allow a certain type of clause and the word family to which a term belongs. Instead of searching an alphabetical list for a word such as "wrote," Mor·Proof recognizes its relationship to the root word "write." This information helps the program determine parts of speech, sentence structure, and the presence of errors much more accurately than was possible previously. Another advantage of using Mor·Proof is the improvement in spelling verification: *Grammatik IV* scored 87.5 percent on our spelling tests; *Grammatik 5* went up to 91.5 percent.

Among the other enhancements in *Grammatik 5* are new style rules and customizing features that permit you to tune the program to your individual needs. *Grammatik*'s help utility has been enlarged, and bookmarks have been added so you can suspend the program and resume proofreading later on. A useful feature is the program's ability to display a sentence with its parts of speech labeled. And, like other packages of this type, *Grammatik 5* will test your documents for readability.

There are only a few things that are worth complaining about: *Grammatik 5* displays only a small portion of your document onscreen; you cannot underline in the program's editing mode; and you cannot edit text more than half a page before or after an error.

Grammatik 5 for Windows can be integrated with popular Windows word processors, and it will scan documents from the Windows Clipboard and from many DOS- and Windows-based programs. *Grammatik 5* is easy to learn, its command buttons are well defined, its documentation is good, and it's a breeze to use. While *Grammatik 5* can't guarantee a completely error-free document, it comes closer to that ideal than any other grammar checker. ■

List Price: *Correct Grammar for Windows*, Version 2.0, $119; upgrade, $29. **Requires:** 2MB RAM, 1MB hard disk space, Microsoft Windows 3.0 or later. WordStar International Inc., 201 Alamedo Del Prado, P.O. Box 6113, Novato, CA 94949; 800-523-3520, 415-382-8000.

CIRCLE 420 ON READER SERVICE CARD

List Price: *Grammatik 5 for Windows*, Version 1.0, $99; upgrade, $34.99. **Requires:** 2MB RAM, 2.2MB hard disk space, Microsoft Windows 3.0 or later. Reference Software International, 330 Townsend St., San Francisco, CA 94107; 800-872-9933, 415-541-0222.

CIRCLE 421 ON READER SERVICE CARD

Express Publisher Brings Ease to Basic DTP

HANDS ON

Microsoft Publisher threw down the gauntlet for real desktop publishing power in an inexpensive, easy-to-use Windows package. Power Up Software has met this challenge with *Express Publisher for Windows*, a $249.95 package that is nearly as simple to use as the $199 *Microsoft Publisher* and offers even more features, though at the cost of speed.

To make the program even more attractive, Power Up bundles with it *Adobe Type Manager* and its own *TextAppeal for Windows* (a program for creating logos and fancy headlines).

Express Publisher provides all that most people will ever need for creating newsletters, fliers, or brochures. You can use one of the well-designed templates as a starting point or begin from scratch. Either way, you can be confident that the program will accommodate nearly any design intricacies you might throw at it.

A superb frame-based interface with toolbox icons makes it a breeze to perform such tasks as flowing text from one frame to another or layering many document elements. Extra touches, such as an editable thumbnail view that displays all pages at once, make the interface especially appealing.

Along with the usual rulers and snap-to-guide functions, other aids minimize the fuss of positioning document elements. You can group text and graphic elements together and move them as a single block, and you can automatically align several frames with each other in myriad ways or you can resize them.

Express Publisher for Windows' thumbnail view displays all pages at once for editing. *TextAppeal* lets you fashion logos and paste them into your document.

Thanks to *Adobe Type Manager*'s 23 scalable fonts, you're unlikely to be at a loss for the right one, and *Express Publisher*'s stylesheets make it easy to handle all of them. The program supports automatic hyphenation with an editable dictionary. There's a spell-checker and even a search-and-replace function.

Working with columns is more difficult than in *Microsoft Publisher*, since the program won't format text in columns within a frame. You must create a separate frame for each column and then link them. Another drawback is the 48-page limit on document length.

Express Publisher's biggest weakness is its sluggish performance—a problem that is compounded by unnecessary redraws. On a 16-MHz 386 with 6MB of RAM, the program's snail-like pace became a serious obstacle to productivity. If this problem is resolved, *Express Publisher* will help redefine the low end of desktop publishing. ■

List Price: *Express Publisher for Windows*, Version 1.0, $249.95. **Requires:** 2MB RAM (4MB recommended), 5MB hard disk space, Microsoft Windows 3.0 or later. Power Up Software Corp., 2929 Campus Dr., San Mateo, CA 94403; 800-851-2917, 415-345-0551.

CIRCLE 419 ON READER SERVICE CARD

GIVE YOUR DOCUMENTS TEXTAPPEAL

TextAppeal is a striking little program that Power Up bundles with *Express Publisher for Windows* or offers standalone for $129.95. It lets you fashion flashy logos or headlines and paste them into *Express Publisher*, or export them as .CMG, .PCX, TIFF, or .WMF files.

You can rotate text, curve it around a circle or Bezier curve, add drop shadows, stretch one axis, or create quasi-perspective effects. A graphics import feature and drawing tools can add to the elegance of your creations.

Since you can interactively edit the size, curve, and position of each text block, the concocting of elaborate logos is a surprisingly simple task. The package even includes a good assortment of logo templates.—*RK*

QEMM-386 v.6

The Power Behind the Best-running DOS and Windows Systems

From DOS 3.3 to Windows 3.1, QEMM is the best memory manager you can run.

Our new QEMM-386 version 6 is the best way to get the most out of memory. It 'pools' all your memory so that it's available in whatever form your programs need—expanded or extended. You don't even need to know the difference. QEMM does it all for you. Instantly. Whereas DOS 5, for example, requires you to figure out what you need, then manually allocate memory and re-boot every time you need to change.

> "It's nothing less than a dream come true"
> —*Steve Gibson InfoWorld 8/26/91*

As for the all-important 'conventional' memory area, our new QEMM-386 v.6 increases the amount of memory freed-up. Our exclusive 'optimize' feature automatically seeks out TSRs, utilities and device drivers and moves them into high memory—the area between 640K and 1 megabyte.

PC Week rated QEMM 6 the best memory manager.

All you need to do is type 'OPTIMIZE'.

QEMM-386 v6 finds more high memory than any other memory manager. *Byte Magazine's* tests showed it produced net memory gains of 21K to 132K over DOS 5.0 alone, for instance.

Stealth takes you to network and TSR heaven.

Our breakthrough 'Stealth' technology makes available areas normally taken up by ROM. Areas that QEMM-386 can use to load memory-hogging drivers and TSRs. Big programs can get the memory they need to run fast and efficiently. And you get to have your TSRs.

Not every PC can benefit from Stealth. But every PC can benefit from *'Squeeze'*—our new feature to accommodate those TSRs that need more memory at start up and less when they're resident. Memory allocation is temporarily increased, then squeezed down after it's needed.

#1

QEMM is the number one selling PC utility.

QEMM can use idle video memory to produce a further 96K gain on EGA and VGA systems when running character-based programs.

A priceless $60 bonus.

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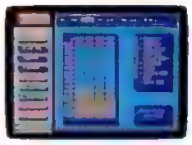

Manifest does for memory what Norton Utilities does for disks.

Big Windows Benefits, too.

Whether you're running DOS 3, 4, 5, or Windows 3.0 or 3.1, QEMM can improve your 386/486's performance.

That means you may not need a faster CPU. You may not even need more RAM. QEMM makes your favorite programs work better by giving them more memory.

QEMM helps you get the most out of the software you own today.

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Key to comparison table: Software compatibility is defined as the product's ability to run without problems with the operating systems PC Week Labs used in testing, MS-DOS 5.0, IBM PC DOS 5.0 and Microsoft Windows 3.0, and with a variety of application software including Quarterdeck's DESQview 2.40, Xerox Ventura Publisher 3.0 for DOS, WordPerfect 5.1 and Artisoft's LANtastic 4.0. Hardware compatibility is defined as the programs ability to run on PC Week Lab's test hardware platform, which included a 33MHz 486-based PC and a 25MHz 386-based IBM PS/2 Model 80. Reliability ratings are based on the successful and dependable performance of each operating system and application software package under each memory manager. Ease of use is based on ease of installing and configuring each program, based on support for automatic loading features and the intuitive nature of the interface. Flexibility in managing memory is rated on the range and quality of the product's features in optimizing system performance and handling special-case installation. Quality of documentation is judged by the clarity, comprehensiveness and helpfulness of the documentation provided with the product, based on the organization of the manuals as well as the thoroughness of definitions, directions and explanations, and the inclusion of troubleshooting information.

CIRCLE 338 ON READER SERVICE CARD

Citrix and Novell Update Their Multiuser Operating Systems

HANDS ON
by Joe Salem

There's an inexpensive way to share the power of a single PC among multiple users: Run a multiuser operating system. Building such a system on a limited budget is what Citrix Systems' Citrix Multiuser and Novell's (formerly Digital Research's) DR Multiuser DOS do best. Both operating systems have added a number of enhancements since we looked at them last fall ("Two Ways to Run a PC as Host: Digital Research Replaces DOS and Citrix Builds on OS/2," First Looks, September 24, 1991). In the case of DR Multiuser DOS, the updates are minor; Citrix, however, is a completely revised multiuser version of OS/2 2.0.

CITRIX MULTIUSER

Citrix Multiuser 2.0 now supports both DOS and 32-bit OS/2 2.0 (except for Presentation Manager applications and the Workplace Shell) and allows connected PCs to access shared programs on the host system.

Other enhancements enable individual DOS sessions to access EMS or XMS memory, as well as load TSRs into the upper memory blocks (UMBs) provided by OS/2 2.0's DOS emulation.

Users can now run Citrix on a FAT (file allocation table)–based drive, though an HPFS-formatted (High Performance File System) disk is still required to provide full file and system security (similar to the security provided by *Microsoft LAN Manager* 2.1). When run on a FAT drive, the OS provides only user-level security.

Citrix is compatible with most DOS applications and supports graphics modes up to VGA resolution. However, there is still no support for Windows 3.*x* programs or programs that require the OS/2 Presentation Manager.

The OS is also able to manage terminals connected to the system through a dial-in or direct connection made with an ASCII-based communications program. You can also use the optional $99 *Multiuser Link* terminal program. Support for a number of terminal types is included.

Since Citrix uses OS/2's virtual memory capabilities to swap excess data to disk, the number of active sessions is limited only by RAM and disk space.

Network support is provided through the standard *Microsoft LAN Manager* 2.1, *IBM LAN Server* 2.0, or Novell's *NetWare* OS/2 2.0 Requestors. Once the Citrix host is connected to the network, individual users can connect to the network drives through the usual network programs.

A dual boot option enables the OS to switch between Citrix and a straight DOS machine. With the Boot Manager, you can choose among different operating systems and run a secure Citrix HPFS system on a disk partition without giving up access to DOS.

In many ways, Citrix Multiuser 2.0 has more capabilities than DR Multiuser DOS. Its biggest advantages are the use of virtual memory, large memory support for DOS applications, support for 32-bit character-mode OS/2 applications, and support for dial-in connections. If you want a relatively low-cost multiuser system and don't need Windows or Presentation Manager application support, you'll find Citrix Multiuser 2.0 the best choice available today.

DR MULTIUSER DOS

The enhancements in DR Multiuser DOS, Version 5.1—the first release of Digital Research's Multiuser DOS since the company's takeover by Novell—are mostly, and not surprisingly, in network support.

Novell has added explicit support for multiple log-ons to a *NetWare* server by users on the multiuser host. This lets directly attached terminals connected to a MUDOS system access files and programs on *NetWare* servers. Up to 16 simultaneous client sessions are supported with a single network card, which is also the maximum number of terminals supported by MUDOS.

The number of DOS sessions per terminal can be configured by the administrator and is limited only by system memory. Virtual memory is not supported. Novell is positioning this capability as a supplement to its networking systems, providing a low-cost method of connecting multiple terminals to the LAN through a single card.

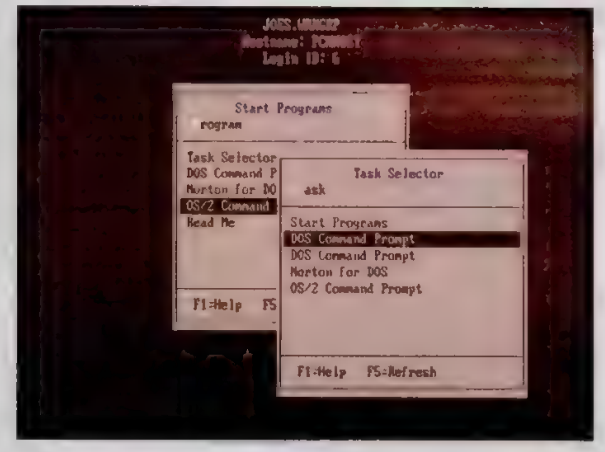
LIMITED GRAPHICS

Terminal graphics are still limited to CGA, however, and Novell has not yet dropped the need for a parallel port hardware key to use MUDOS. (Some OEM versions ship without the need for the hardware protection.)

The dual-boot option of DR Multiuser DOS has been enhanced to match that in DR DOS 6.0. Users can now choose between a number of possible operating systems to boot on, including DOS, MUDOS, and OS/2.

Novell has added Windows 3.0 support, but only on the host system and only in Real mode. As Windows 3.1 eliminates Real mode, MUDOS is not yet compatible with it, and there's been no word yet from Novell on whether or not this issue will be resolved. If you don't need Windows support, you can use MUDOS as a single-user multitasking DOS system, though there are better (and less expensive) alternatives.

Though still lacking better-than-CGA graphics capabilities and virtual memory support, MUDOS is particularly suited for running a primary shared application, such as an accounting system or a database. The addition of *NetWare* support also makes it an attractive way to add a large number of users to a LAN inexpensively, provided they don't need access to graphical applications. ■



Citrix Multiuser 2.0 provides multiuser support for character-based DOS and OS/2 programs on a single host. The Task Selector lets you access and control different tasks.

List Price: Citrix Multiuser, Version 2.0, $995 (five users); doubler pack (doubles authorized users), $495; upgrade, $99. **Requires:** 6MB RAM, 20MB hard disk space, comm port. Citrix Systems Inc., 210 University Dr., #700, Coral Springs, FL 33071; 800-437-7503, 305-755-0559.

CIRCLE 426 ON READER SERVICE CARD

List Price: DR Multiuser DOS, Version 5.1, $695; upgrade, $24.95. **Requires:** 2MB RAM plus 1MB per additional three sessions, 2MB hard disk space, parallel port, comm port. Copy-protected. Novell Inc., Box DRI, 70 Garden Ct., Monterey, CA 93942; 408-649-3896.

CIRCLE 427 ON READER SERVICE CARD

FOR DOS OR WINDOWS

Yank Writing Errors Out By The ROOTS

It's a quantum leap in proofreading power for PCs. Introducing Grammatik™ 5 for DOS and Grammatik 5 for Windows.

THE POWER

Grammatik 5 uses a powerful new technology called Mor•Proof™ (morphological proofreading) to analyze parts of speech using root words. It's not fooled by prefixes, suffixes, and conjunctions, so it identifies nouns, verbs, and other parts of speech with unprecedented accuracy. And it ferrets out even the most complex grammar errors with ease.

MOR•PROOF™

Subtle writing errors like tense shifts and incorrect verb forms are ripped out like weeds. Comma splices and conjunctive clause errors are clipped, before they can cause you embarrassment.

Yet for all of its error detection prowess, using Grammatik5 is still as easy as using a spelling checker.

THE PROOF

But precision proofreading is just the beginning. Virtually everything that's made Grammatik the #1 grammar and style checker is now even better.

Of course, it still proofreads your writing for errors in grammar, style, punctuation, usage, and spelling. But now, Grammatik checks 58 comprehensive classes of writing rules, protecting you against literally hundreds of thousands of possible errors.

Grammatik 5 includes specific error-checking patterns for ten writing styles from advertising and business letters, to proposals and fiction. It works inside all major DOS and Windows word processors including Word, WordPerfect, and Ami Pro. And, it even has an instantly accessible writing guide with "Hot-Word" writing advice linked specifically to errors you've made.

THE PAYOFF

Which brings us to the payoff: Better writing.

If you use Grammatik 5, we guarantee it will improve your writing immediately, or your money back.*

At the touch of a key, your writing will communicate more clearly, it will be tighter, smarter, and error-free. Everything you write, every letter, memo, and proposal will present you at your best.

So rip those writing errors out by the roots with Grammatik 5. You'll discover what 1.5-million users already know. Grammatik is the easiest way to improve your writing.

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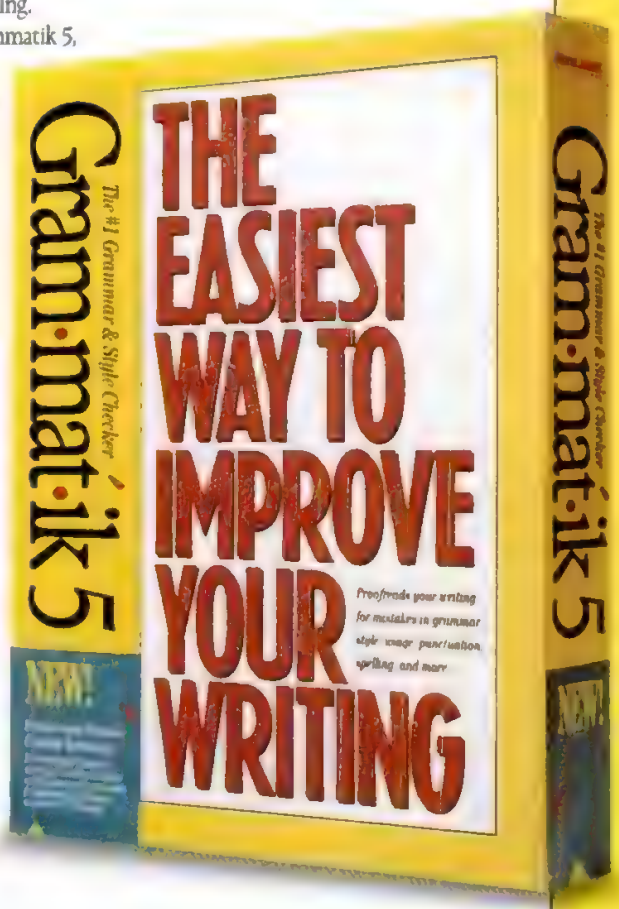

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330 Townsend Street, San Francisco, CA 94107 *See participating dealer within North America for details. **Grammatik users upgrade for $34.99 plus tax/shipping. RightWriter and Correct Grammar users upgrade for $44.99 plus tax/shipping. Call 1-800-872-9933 for details. Offer expires July 31, 1992. Limit one per customer. Grammatik, The Easiest Way To Improve Your Writing, and Mor•Proof are trademarks of Reference Software International. Other brand/product names are trademarks of their respective holders. © 1992 Reference Software International

CIRCLE 076 ON READER SERVICE CARD

Serious About SCSI: Corel Embraces Universal Peripheral Interface

HANDS ON
by M. Keith Thompson

Over the years, PC users haven't had the opportunity their Macintosh counterparts have had to enjoy the simplicity of using SCSI (small computer system interface) peripheral devices. Corel Systems, best known for its powerful graphics program, *CorelDRAW*, is taking on the tremendous task of taming the DOS, *NetWare*, and OS/2 SCSI world.

At $325, its CorelSCSI solution includes a 16-bit bus-mastering host adapter (using NCR SCSI chips), driver software for SCSI devices, and cabling. The package offers not only ease of use and flexibility, but also strong device support. Suddenly, Adaptec, the leader in SCSI interfaces, has serious competition.

The theory behind SCSI has always been that multiple SCSI devices should operate off the same controller, but until now, this hasn't been the case. While many devices claim to be SCSI-compliant, they sometimes require their own individual SCSI adapters and don't work with other SCSI cards or devices. This incompatibility requires users to have multiple SCSI cards in their computers (see Trends, April 28, 1992).

WIDE SUPPORT

Corel is committed to supporting all major SCSI devices—from Iomega's Bernoulli drives to the new 20MB optical floppy drives—and to running them all off one controller. The current release supports all 0.25-inch tape, DAT, CD-ROM, WORM, rewritable, multifunction, and hard disk drives. We successfully attached all of the above to PCs running both DOS and OS/2. Corel provides compatibility with SCSI-2 and the soon to be certified SCSI-3.

There are four separate products in the CorelSCSI line. In addition to the 16-bit package, there are $150 8-bit kits for ISA and Micro Channel systems. The 16-bit kit has the advantage of offering up to a 10MB-per-second data-transfer rate. A $99 software-only solution provides all the same functionality but operates on Adaptec ASPI-compatible host adapters. The current list of supported host adapters includes models from Adaptec, BusTek, Mylex, and Ultrastor.

TERMINATION

Anyone experienced with SCSI devices is aware of the problems related to terminating the daisy chain of peripheral connections in a SCSI setup. If both ends of the SCSI bus are not terminated properly, the SCSI devices behave unpredictably. Corel's 16-bit kit includes a unique "auto-sense termination" capability. This new feature eliminates the need for users to hassle with terminators, saving hours of troubleshooting time and guaranteeing more reliable operation.

CorelSCSI lets users add all types of peripherals to *NetWare* networks as well. CorelSCSI's *NetWare* Loadable Modules (NLMs) provide *NetWare* clients access to laserdisk drives in addition to hard disks and tape drives. There's also support for CD-ROMs on *NetWare* servers. CD-ROM drives attached to the file server become available for all users on the network. A menu-driven NLM runs on the server to mount and dismount the CD-ROMs. After loading MSCDEX on the clients, you use the menu-driven CDMAP program to assign a drive letter to the CD-ROM of your choice.

DOCUMENT MANAGEMENT

With CorelSCSI, *NetWare* networks can manage huge amounts of data for all types of applications. CorelSCSI transparently moves data from a *NetWare* volume to the cartridges in a laserdisk jukebox. Even though it can take up to 8 seconds to access data stored on a cartridge, it is much faster than looking for information in a filing cabinet.

CorelSCSI eliminates most of the waiting time by caching the most recently used data to a hard disk. Similar to the way disk caching programs work, the software leaves the data in use on a fast access hard disk, and as the user accesses other pieces of data, the NLM moves the oldest data to the slower cartridges.

From a reliability and safety standpoint, the jukebox software is brilliant. CorelSCSI stores data on the laser cartridges in a format that's readable from the DOS version of CorelSCSI. You can move the laser drive to your PC and access your data even if the *NetWare* server is down.

Corel markets its own laserdisk jukeboxes and supports systems from Pioneer and Panasonic. We successfully tested CorelSCSI with a 50-gigabyte Panasonic LF-J7000A jukebox attached to a BusTek SCSI Host bus adapter in an ALR PowerPro.

Each CorelSCSI kit includes SitBack Technologies' *SitBack* backup software and a videotape to make installation as simple as possible. With its low cost and vast array of device support, CorelSCSI provides a great new way for PC users to make easier peripheral connections. ■

List Price: Corel SCSI, 16-bit kit, $325; 8-bit kit, $150; software only, $99. **Requires:** DOS 3.2 or later. Corel Systems Corp., Multimedia Systems Division, 1600 Carling Ave., Ottawa, Ontario, Canada K1Z 8R7; 800-836-7274, 613-728-8200.

CIRCLE 434 ON READER SERVICE CARD

Microsoft Publishes In-Depth Guide to Windows

HANDS ON
by Barry Simon

What do you get the Windows power user who has everything? Perhaps Microsoft's $19.95 *Microsoft Windows Resource Kit for Windows*, Version 3.1, a 537-page potpourri of useful information that includes a disk of utilities.

In the *Resource Kit*, many Windows features are documented in much greater depth than in the regular Windows documentation. For example, the *Resource Kit* explains about 150 commands for the 386-Enhanced section of SYSTEM.INI (50 are new in Windows 3.1), while the READ.ME file on the Windows disk documents only about 30.

Topics discussed in the book include installation, the two .INI files, memory management, the difference between the old and new SMARTDrive, optimization tips, setting up DOS apps, object linking and embedding (OLE), printing, and networks. The prose is clear, and numerous flow charts are provided to explain actions you should take when troubleshooting.

Special attention is paid to the features that are new in Windows 3.1 and are indicated by the 3.1 logo in the margin. TrueType is discussed extensively in the 28-page chapter on fonts. And (OLE) is the subject of an 18-page chapter on compound documents.

A glossary; a list of third-party resources; an explanation of all the Windows 3.1 files; and articles on Windows for Pen Computing, *QEMM*, and Windows 3.1, PC-NFS, and FastDisk are also included.

The companion disk has six applettes including a viewer for .BMP, .ICO, and .WMF files; a SMARTDrive monitor; and *TopDesk*, a virtual desktop program that expands the desktop beyond the edges of your screen (similar to Attitash's *WideAngle*). Since the viewer is written in Visual Basic, a Visual Basic runtime version is included, as are a number of extra device drivers. ■

List Price: *Microsoft Windows Resource Kit for Windows*, Version 3.1, $19.95. Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-642-7676.

CIRCLE 435 ON READER SERVICE CARD

CA-Textor: Word Processor With French History

HANDS ON
by Edward Mendelson

If you wonder why Computer Associates' $225 *CA-Textor* looks and acts differently from other Windows word processors, consider its French ancestry. This midlevel package, a Windows port of a DOS program sold in Europe, has features that belong in all word processors. No American program had them until now. To use these features, however, you have to work around *CA-Textor*'s roadblocks and inconveniences. This is the kind of program that is worth getting to know in this version, but it will probably be splendid in the next release.

In speed and abilities, *CA-Textor* resembles powerhouse programs like *Microsoft Word for Windows* but suffers from many of the limitations of clumsier packages like *WordStar for Windows*. You can edit eight files at once, but you can't record macros. You can automate documents with preset and user-defined fields that include advanced functions for manipulating numbers and strings, but the keyboard, which you can't customize, lacks a one-keystroke shortcut for deleting a word.

The mail-merge feature, which reads *dBASE* files and prints mailing labels, displays all entries in your data file in a window and dynamically displays field contents in the document on-screen. But until you select a data file, the merge fields in the document display only as a code that says "ref.: You have to click on it to discover its name.

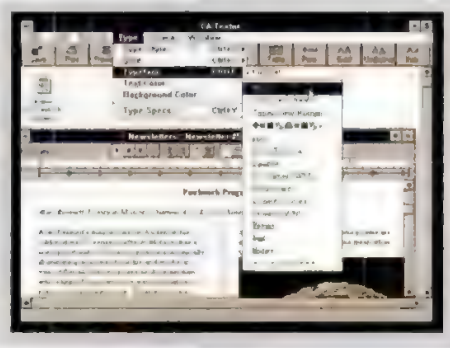
A powerful but clumsy table editor makes you enter text in cells by opening a text window instead of typing directly into the cell, but you can import graphics into cells. Other graphics support is minimal; you can't create a horizontal line across the page without importing a line created by a graphics program or by making an empty table and hiding all borders but one.

THREE EDIT MODES

CA-Textor gives you three ways to edit: in full WYSIWYG mode, in a "standard" mode that uses a thin line to represent page breaks but doesn't show headers and margins, or in a draft mode that uses Windows' system font. Standard mode is easiest to work with, but can clutter the left margin with paragraph markers or move the text too close to the window border for comfort.

Page formatting uses templates, with customizable standard formats available for all documents and separately definable formats for individual files. The program imports *Microsoft Word* (DOS) stylesheets and *WordPerfect* formatting startlingly well, but recognizes few other file formats.

CA-Textor may not be the program you need today, but future versions may be indispensable. Meanwhile, you would probably be delighted to see its best features added to the program you use now. ■



***CA-Textor* organizes files as documents in folders, with long descriptive names like the one in the title bar. The font menu can list fonts in WYSIWYG mode.**

List Price: *CA-Textor*, $225. **Requires:** 1MB RAM, 3MB hard disk space, Microsoft Windows 3.0 or later. Computer Associates International Inc., One Computer Associates Plaza, Islandia, NY 11788; 800-225-5224, 516-342-5224.

CIRCLE 429 ON READER SERVICE CARD

Any System Can Read SuperStor's 5MB Compressed Floppies

HANDS ON
by Greg Pastrick

On-the-fly data compression is a great idea, but one big catch has always been the inability to exchange compressed floppy disks between systems that don't have the same disk-expanding compression software. AddStor's *SuperStor* 2.04 gets beyond this limitation in a way that our last Editors' Choice pick in this category, *Stacker* ("Double—No—Triple Your Hard Disk Space with On-the-Fly Data Compression Utilities," January 28, 1992), cannot yet match.

Using what the company calls Universal Data Exchange (UDE), *SuperStor* lets you prepare standard floppy disks to hold compressed data that can be read and used in uncompressed format by any DOS-based system, with or without *SuperStor* installed. AddStor achieves this through a simple procedure executed from the primary *SuperStor* utility, SSTOR, which sets up hard disks and logical drives as *SuperStor* mountable disks.

In effect, each compressed floppy created by SSTOR holds a read-only version of the *SuperStor* driver in the form of a 20K TSR. The driver expands and compresses the files and data placed on the floppy. The 20K overhead is easily dismissed when you realize that over 5MB of disk space at a maximum 8:1 compression ratio can be created on a 720K 3.5-inch floppy.

The capability to pass disks with compressed executable files on them has long been available from compression utilities like PKZIP, but never with selectable compression ratios to fit specific file types, nor with the capability to maximize and expand available floppy disk space like this.

DATA TRANSFER

The reality of 3 to 5MB of compressed space promotes a revival of sorts for standard floppies as a transport medium for large files. The UDE concept has its limits, though. The compressed disks and files are write-protected, so unless the system receiving them also has *SuperStor*, it's a one-way trip for UDE.

Other notable additions to *SuperStor* 2.04 are analysis and repair tools for optimizing compressed disks and a set of Disk Tuneup utilities for defragmenting and recompressing mountable disk space. *SuperStor*'s recompression feature adds a second-level scan of compressed data using AddStor's proprietary lossless algorithm in a more thorough search for pattern matches missed on initial compression.

Overall, graphics files show the highest boost in compression ratios when recompressed because of the redundancy of information contained in them. To improve performance and access speed, Disk Tuneup offers options for full and partial defragmentation of compressed disk space, too.

Despite its new packaging and documentation, *SuperStor*'s look has changed little. Access to the setup and utility menus, as well as some of the program's primary features, is handled directly from the command line.

But in the end, you don't buy compression software for the interface. You buy it for the space it opens up on your hard disk. The new *SuperStor* gives you ways to open up even more. ■

List Price: *SuperStor*, Version 2.04, $139. **Requires:** 512K RAM, DOS 3.2 or later. AddStor Inc., 3905 Bohannon Dr., Menlo Park, CA 94025; 800-732-3133, 415-688-0470.

CIRCLE 428 ON READER SERVICE CARD

Crosstalk Improves Already Impressive Set of Communications Tools

Crosstalk, Digital Communications Associates' flagship communications program and one of the top programs in its class, now offers a number of new features that make PC communications more flexible and powerful. Its latest version, *Crosstalk Mark 4*, Version 2.1 ($245), brings new terminal emulations, improved file-transfer protocols, an improved dialing directory, and new script commands to an already impressive feature set.

The main enhancements are in the dialing directory, where *Crosstalk Mark 4* now has the built-in ability to queue up a series of directory entries and dial them in order. You can then save queues to disk and recall them for later use.

Crosstalk Mark 4 also offers a convenient feature for calling multiline systems: the ability to enter multiple phone numbers into a single directory. If the first number doesn't connect, the program will cycle through the rest of the numbers until a connection is made.

You can now add long-distance carrier credit card numbers into a dialing entry using the new "[W" command, which pauses dialing between numbers. This feature requires a modem with a speaker (so you will know when it's time to hit the Spacebar to send the next series of numbers). Finally, the Answer/Host mode module has been improved to provide a definable menu to callers that lets them change drives and directories before transferring a file.

The program now offers support for WYSE 50 and 60 series terminal emulations and Hewlett-Packard 239x and 252x emulations. PCs running *Crosstalk Mark 4* can also act as VAX terminals across a LAN, made possible by support for the LAT (Local Area Transport) protocol used by DEC hosts.

Another improvement is an enhanced "crash recovery" feature in the ZModem file-transfer protocol module that provides more reliable transfers. You can resume aborted transfers from where you left off.

The Crosstalk Applications Script Language (CASL) has 12 new commands, including support for queue dialing and international character sets, and it has the ability to import and export directory entries so that they can be shared among multiple *Crosstalk* users. There's an auto-log-on script for the GEnie Information Service; a video driver for the Compaq VGA video card; new scripts for viewing .ARC, .ARJ, .LZH, .ZIP, and .ZOO file archives; and a split-screen CHAT mode for services such as CompuServe's CB conference.

Considering all these improvements, current *Crosstalk* users should upgrade, and those looking for a new communications program should give this version a try. ■

A major enhancement in *Crosstalk Mark 4* is the ability to create a dialing queue. Directory entries are added by highlighting the entry and pressing the Spacebar.

List Price: *Crosstalk Mark 4*, Version 2.1, $245; upgrade, $65. **Requires:** 320K RAM, 1.5MB hard disk space, DOS 2.0 or later. Digital Communications Associates Inc., 1000 Alderman Dr., Alpharetta, GA 30202; 800-348-3221, 404-442-4930.

CIRCLE 425 ON READER SERVICE CARD

Intel Joins the Network Virus Hunt with LANProtect

With *LANProtect*, a $995 *NetWare* Loadable Module (NLM) that provides real-time continuous file server virus protection, Intel Corp. has broken new ground in the battle against computer viruses.

LANProtect can operate in four different modes: three server-based, one workstation-based. The program's real-time mode scans all files before they are written to or read from the file server, or both. You can configure *LANProtect* to scan all DOS files, a select list of DOS extensions, all Macintosh application files, or all Macintosh files that contain a resource fork and data fork.

Should the scan find a virus, *LANProtect* will let you rename the infected file so that it can't be executed, delete and purge it, leave it unchanged, or move it to a supervisor-specified directory for inspection. Optionally, *LANProtect* will notify the offending user or a specified Novell group of the virus detection. (Registered users receive one year of free access to Intel's virus pattern library updates on its bulletin board.)

LANProtect also makes an entry to a log file or prints a report directly to a file-server queue. Though the real-time scan adds a barely noticeable overhead—approximately 50 milliseconds per file—it affords the maximum level of protection.

A manual scan mode runs an on-demand scan of specific volumes and directories with the same file options and virus disposition options as the real-time scan. Intel recommends a manual scan of all volumes immediately after installation to ensure that the file server is "clean" as you start using *LANProtect*.

A prescheduled scan lets you set up daily, weekly, or monthly scans at a specific time. This mode is useful for administrators who don't want the overhead of a real-time scan but want to scan each day before launching a backup.

WORKSTATION SCANNING

The workstation scan (LPSCAN .EXE) is a DOS executable file that scans workstations against the same virus pattern library used by *LANProtect*. The workstation needs to be logged in and have access to the virus pattern library in order to run LPSCAN. LPSCAN scans workstation memory, the boot sector, the partition table, and the local workstation files. Unlike some other antivirus products, LPSCAN will not attempt to repair an infected file. It is only capable of deleting an infected file.

All server-based scan modes create entries in a log file. From this file, *LANProtect* generates reports to a file, to the file server console, or to a print queue. After a user-specified number of days, *LANProtect* will clear the log file and generate a report.

LANProtect provides a complete server-based virus solution for *NetWare* 3.1*x* file servers. Its real-time scan mode provides continuous protection for DOS and Macintosh files with no workstation TSR overhead. If you're looking for an automatic server-based solution to the network virus threat, *LANProtect* is a smart solution. ■

List Price: *LANProtect*, Version 1.0, $995 per file server; $9,995 for 20 file servers. **Requires:** 275K RAM, *NetWare* 3.1 or later. Intel Corp., 3311 N. University Ave., #200, Provo, UT 84604; 800-573-3372, 801-379-2200.

CIRCLE 434 ON READER SERVICE CARD

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CIRCLE 285 ON READER SERVICE CARD

Video in a Window Looks Good with Win/TV

HANDS ON
by Jonathan Matzkin

You can put a spreadsheet or a document in a window, so why not on a TV screen? That's exactly what Win/TV ($499), a hardware/software combination from Hauppauge Computer Works, lets you do.

The screen can be adjusted to any size, just as with any other Windows application. You can bump the picture up to full screen size or shrink it all the way down to an icon, which continues to display a live thumbnail image as it sits at the bottom of your display. The accompanying software allows you to freeze the screen at any point and save the image in your choice of .BMP, .TGA, TIFF, or IBM M/Motion formats.

The full-length Win/TV board has a TV tuner on-board; all of the TV image processing takes place on the card, so the effect on PC system performance is negligible. The Win/TV card intercepts the output from your VGA display and passes the signal through to your monitor.

The board accepts input from up to three simultaneous sources. A standard coaxial input connects to an antenna or cable TV cable. An optional multiheaded cable ($49) provides two RCA jacks that accept input from other sources such as video cameras or VCRs.

The optional cable also adds a full complement of audio inputs and outputs to the miniplug audio jack that comes standard. The board supports stereo sound and decodes MTS stereo sources. The image from each Win/TV board you install occupies a separate on-screen window.

An icon bar at the top of the display controls volume, selects channels, mutes the sound, zooms the display, and freezes the image. At the extreme left of the icon bar, a pull-down menu labeled "Display" allows access to audio, video, and capture functions. When Win/TV's "Fit" mode is selected, the software squeezes the entire TV image into the window, regardless of the size and shape of the window. Turning this mode off allows the TV image to be scrolled around inside the available window space. Selecting the "Aspect Ratio" menu choice adjusts window dimensions to the nearest size that maintains a 4:3 ratio.

The software displays a crisp image at both 640-by-480 and 1,024-by-768 resolutions. 800-by-600 support is somewhat lacking, but Hauppauge promises to remedy this problem soon. The Win/TV board generates a remarkably good-looking TV image, even though the resolution and sharpness aren't as good as they are on a high-quality TV set. Rapid motion produces some localized image breakup, and there is visible noise surrounding some on-screen objects.

The $499 Win/TV board lets you put a live, real-time TV window of any size onto your screen.

Win/TV could provide a low-cost way to include still video images in DTP documents. The board also has obvious applications in surveillance and security, and busy executives may find it helpful to have access to TV programming on the same screen where they display spreadsheets and memos. Win/TV drives home the idea that useful, fascinating technology need not be prohibitively expensive. ■

List Price: Win/TV, $499.
Requires: Microsoft Windows 3.0 or later, VGA display or better. Hauppauge Computer Works Inc., 91 Cabot Ct., Hauppauge, NY 11788; 800-443-6284, 516-434-1600.

CIRCLE 431 ON READER SERVICE CARD

Blast Adds Remote Control to ProComm Plus

HANDS ON
by Carol Ellison

US Robotics has made PC-to-PC remote control as easy as dialing up CompuServe from your *ProComm Plus* dialing directory. *Blast Remote Control for use with ProComm Plus* brings the name, speedy protocol, and remote-control engine of *Blast Professional*, the company's high-end communications program, with the ease and familiarity of *ProComm*, the leading communications program.

The $69 *Blast Remote Control* is, essentially, a *ProComm* add-in. On the host PC, the one you want to take control of, *Blast Remote Control* installs in its own directory and loads as a TSR called Prohost. On the remote, it installs in the *ProComm Plus* subdirectory and places two phone entries in the *ProComm* dialing directory: one entry for taking control of the host PC and another for file transfers only. *ProComm* dials the host, makes the connection, and then invokes *Blast*'s CONTROL.ASX script file, which begins the *Blast* logon process.

FAST BLAST

Prohost, which runs on the host PC, uses *Blast Professional*'s remote-control engine. It operates in the background, letting a user at the keyboard continue to work during connections. The program's error-correcting Blast File Transfer protocol also hails from *Blast Professional*. And it is fast! We transferred a 20K binary file across a noisy line at 2,400 bps in 1 minute 40 seconds, compared with 1 minute 58 seconds using *ProComm Plus*'s Ymodem batch and 3 minutes 50 seconds using *ProComm Plus*'s Xmodem. The *Blast* protocol will also resume interrupted file transfers at the point where the line was dropped.

Security is impressive, with two levels of password protection (a user ID and a personal password), dialback, and separate master passwords for setup parameters and user ID accounts.

But most impressive is the program's ability to translate video standards accurately. A user with a VGA monitor can connect to a CGA or Hercules host, and vice versa, with no distortion of screen images. *Blast Remote Control* also features video scaling, letting you display images in pixel ratios of 1:1, or for faster repaints of graphics screens, 1:4, 1:16, and 1:64. The program also features call logging and screen capture.

Blast Remote Control competes well with other remote-control packages and bests many of them in video translation. However, unlike Norton-Lambert's *Close-Up*, Symantec's *pcAnywhere*, Microcom's *Carbon Copy for Windows*, and Triton Technology's *CO/Session*, it doesn't do Windows. *Blast Remote Control* will display Windows screens but features mouse support only for DOS programs that use MOUSE.COM. Still, at $69, it sells for less than half the amount of the others. And with remote control as an option for *ProComm Plus* users, there is little that's new to learn. ■

List Price: *Blast Remote Control for use with ProComm Plus*, Version 1.0, $69 (one remote and one host PC).
Requires: 250K RAM remote; 85K RAM host; *ProComm Plus*, Version 2.0; DOS 3.1 or later. US Robotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076; 800-342-5877, 708-982-5001.

CIRCLE 430 ON READER SERVICE CARD

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Sebastian Rupley, *PC/Computing*, March 1992

"Quattro Pro 4.0: Improvements add up to the ultimate DOS spreadsheet"
Craig Stinson, *PC Magazine*, April 28, 1992

". . . version 4.0 is arguably the best non-Windows spreadsheet available . . ."
John Walkenbach, *PC World*, March 1992

"Borland is hitting on all cylinders with [Quattro Pro 4.0] . . ."
Raphael Needleman, *InfoWorld*, January 27, 1992

"Quattro Pro version 4.0 looks like the best DOS spreadsheet ever."
Jim Seymour, *Office Technology Management*, February 1992

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Mark Whitehorn, *PC User* (U.K.), March 24, 1992

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CIRCLE 287 ON READER SERVICE CARD

Microsoft C/C++ 7.0: Catching Up to Borland In the Compiler Race

HANDS ON
by Richard Hale Shaw

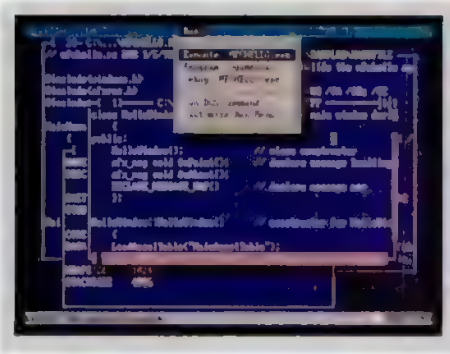
After nearly two years, Microsoft has finally released its new C compiler: Microsoft C/C++ 7.0. With full support for AT&T C++ 2.1, a Windows application framework, updated tools, precompiled headers, and mounds of documentation, the $499 C++ 7 package also includes the entire Windows 3.1 Software Development Kit (SDK). But developers looking for faster compiles and performance gains will be disappointed.

C++ 7 is now a 32-bit, protected-mode DPMI-hosted compiler, so you can run it under Windows from a DOS window and access up to 4GB of memory. It requires a 386 machine with at least 4MB of extended memory and Qualitas's *386MAX*, Version 6.01 (included in the package), to run from the DOS prompt.

Although it's largely an AT&T C++ 2.1–compliant compiler, C++ 7 offers limited support for AT&T C++ 3.0 templates. While other vendors, such as Borland, implement templates in the compiler, C++ 7 provides TEMPLDEF, a command line utility that can generate data types in a C++ source file.

C++ 7 also contains a Windows application framework, the Microsoft Foundation Classes (MFC), with full support for Windows objects such as windows, dialogs, messages, and controls. Graphics device interface (GDI) objects are also supported, along with object linking and embedding (OLE) and the multiple document interface (MDI). There are also general-purpose classes for managing strings, files, and exceptions for use in DOS programs. The 60 MFC classes are small and fast and consume only 39K of RAM when compiled for the small memory model.

Unlike Borland's ObjectWindows Library (OWL) or InMark's ZApp, MFC is less object-oriented and more Windows-oriented. Rather than present a new set of functions to learn, MFC is little more than a thin wrapper over the Windows application programming interface (API). Consequently, it's not for Windows novices: Experienced Windows developers will probably love MFC, but beginners might want to check out the competition.



Many Microsoft C tools have been changed and updated in C++ 7. The Programmer's Workbench, for example, has been considerably revised.

Features that ease application development include a new overlay manager, auto-inlining, and p-code. Auto-inlining lets you generate in-line code in place of small functions, including class member functions that contain WHILE, SWITCH, or FOR statements—something that Borland's compiler won't do. P-code ("packed-code") replaces groups of machine code instructions in your programs. It's easy enough to use, but for the advantages it offers in size reduction, there are penalties in performance.

Both the Programmer's Workbench (PWB) and CodeView (CV) have gotten facelifts. They now offer fully CUA-compatible interfaces with movable, overlapping windows. While the PWB is not yet Windows-hosted, it features a new C++ class browser that displays class hierarchies, data members, and member functions in a tree format. CV 4.0 fully supports C++ and also offers class browsing features during debugging. A remote feature lets you debug a program running on another system and transfer the target executable.

COMPILING SPEEDS

What about performance? We tested C++ 7 against its predecessor for compiling C and against Borland C++ for compiling C++. The results were disappointing. For compiling C, C++ 7 an average of 51percent slower than C 6.0a—69 percent slower on fast compiles and 33 percent slower on optimization compiles. And since the performance of the resulting executables was practically identical, there are no performance benefits gained from compiling your C 6 code with C++ 7.

For compiling C++, C++ 7 was an average 34 percent slower than Borland C++ 3.0—7 percent faster on fast compiles but 64 percent slower on optimization compiles. Surprisingly, Microsoft's executables performed identically to Borland's with two exceptions: C++ 7 was 40 percent faster at integer handling, while Borland's C++ was twice as fast at floating-point. If you're looking for faster compiles and executables, you're not going to get them from this version of Microsoft C++.

If you're a Windows developer, you won't be disappointed with the MFC and SDK in C++ 7. Without a Windows-hosted development environment or integrated template support, it's hard to get too excited about this product, but Microsoft C/C++ 7 is finally catching up to the quality of other C++ development environments for Windows. ■

DEVELOPING FOR WINDOWS WITH C/C++ 7.0

The Windows 3.1 Software Development Kit (SDK) included with Microsoft C/C++ 7.0 contains everything you could need to build Windows applications, as well as support for Windows for Pen Computing and the Multimedia Extensions provided with Windows 3.1.

There are the requisite tools for Windows development—header files, libraries, dialog and resource editors, and the Windows debug kernel—not to mention the four-volume Programmer's Reference and Win32 API Guides. Microsoft also provides tools for the Windows extensions (such as common dialogs, OLE, and the DDE Management Library), file expansion and compression tools, the Tool Helper library, and the 32-bit memory-management library.

The SDK makes C++ 7 a much better value, especially since C 6 and the Windows 3.0 SDK together cost nearly twice as much as C++ 7.
—*RHS*

FACT FILE

Microsoft C/C++, Version 7.0
Microsoft Corp., One Microsoft Way, Redmond, WA; 98052; 800-426-9400; 206-882-8080.
List Price: $499; upgrade, $139 (through June 30, 1992).
Requires: 4MB RAM, 10MB hard disk space (40MB if SDK is installed). DOS 3.1 or later, mouse.
In Short: A powerful development environment for C++ and Windows with precompiled headers, the Windows 3.1 SDK, and great class libraries. A definite upgrade, but with unimpressive compilation and program execution times.

CIRCLE 437 ON READER SERVICE CARD

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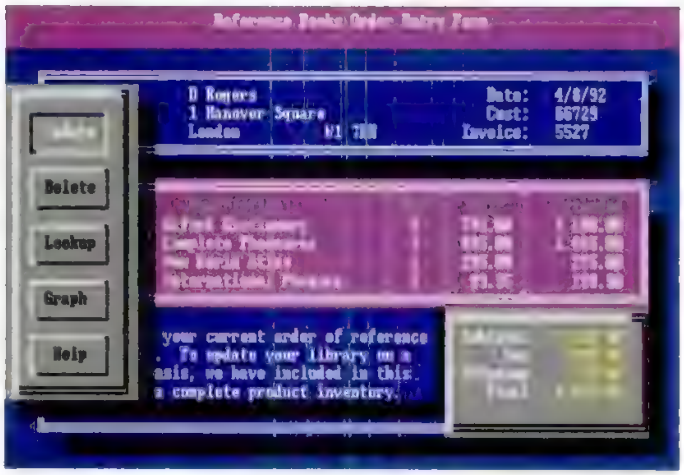
Paradox 3.5 solves your data entry and presentation problems utilizing multi-table forms and reports. Combining data from various tables is simple and quick.



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Software Digest
PARADOX SQL LINK
★★★
Rated # 1
Vol. 8, Number 2
February 1991

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5. Claris
6. Aldus

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*J.D. Power and Associates 1991 Computer End User Satisfaction Study for Application Software Publisher Phase IV Business End User Summary. Responses from Business End Users at 4,396 business sites. †Reprinted from *PC Magazine*, May 28, 1991. Copyright © 1989 Ziff Communications Company ‡Paradox SQL Link and Paradox Engine sold separately. *Software Digest* is a registered trademark of NSTL, Inc. Copyright © 1992 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. BI 1546

CIRCLE 295 ON READER SERVICE CARD

Xerox Rooms Builds Walls On the Windows Desktop

HANDS ON
by Barry Simon

Many of the tools and ideas we use in computing today (mice, laser printers, graphical interfaces) evolved from research at Xerox Corp.'s Palo Alto Research Center (PARC). PARC still exists today, and Xerox has set up a division called XSoft to turn its theoretical ideas into commercial products.

Rooms for Windows, a $99 utility for Microsoft Windows 3.0 or 3.1, is XSoft's first product. Its purpose: to help you organize your tasks while running multiple programs in Windows. *Rooms* works by letting you set up multiple workspaces called, of course, rooms. You might have one room for word processing, another for your PIM, and one for games.

This may sound something like the virtual screen concept of programs such as *WideAngle*, *HotWin*, *hDC Power Launcher*, *Big Desk*, or *Wintools*, but there are important conceptual and functional differences. A large virtual screen doesn't do a good job of separating task sets; you can accidentally bump a window into a neighboring one.

Rooms is based on the idea of separate compartments where you can store sets of programs in full Windows sessions. Like the rooms in your home, each room in *Rooms* can have its own color scheme and even its own wallpaper.

You can place the same instance of a single program in multiple rooms and even run a program iconized in some rooms and full-screen in others. With the program's full-screen overview display of rooms, you can drag applications from one room to another. Moving among rooms is easy; however, you may be disappointed by the lack of hotkeys to help you move around.

To launch a program, just place a button in a room and click. *Rooms*' buttons are similar to those in *Norton Desktop for Windows*. DDE (dynamic data exchange) works fine between programs located in different rooms, but there's no way programs can talk to *Rooms* itself via either DDE or macros.

The program works by using Windows' ability to hide applications. When you switch to a room, all the programs not in that room are hidden, and those that are supposed to be there are made visible. It's a simple scheme that's basically hassle-free.

From *Rooms*' overview display, you can click on an icon or application and get a magnified view of what's inside.

Rooms is a promising first try at a reinterpretation of the Windows desktop. If you use multiple programs in Windows, this is a program you'll enjoy. In a software category that's growing every day, *Rooms* can compete with the crowd. ■

List Price: *Rooms for Windows*, Version 1.0, $99.
Requires: 2MB RAM, Microsoft Windows 3.0 or later. XSoft Business Division of Xerox Corp., 3400 Hillview Ave., Palo Alto, CA 94303; 800-626-6775.

CIRCLE 418 ON READER SERVICE CARD

Paradise Regained: Western Digital Ships Windows Graphics Accelerator

HANDS ON
by Don Hayes

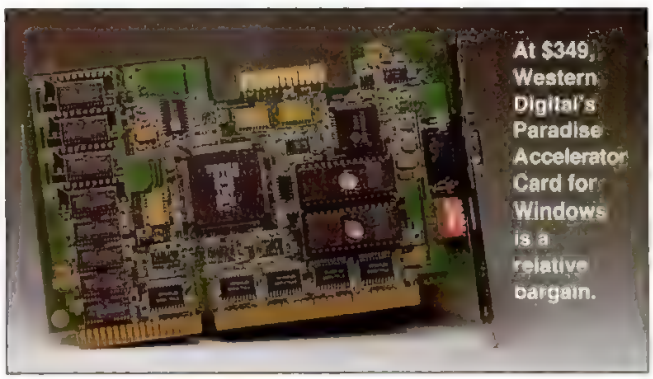
Western Digital, one of the first companies to clone IBM's VGA chip successfully, has entered the Windows accelerator market with a graphics card based on its own WD90C31 chip. Priced at $349, the Paradise Accelerator Card for Windows offers ten resolutions and up to 32,768 colors for Windows users.

The Paradise Accelerator is a half-size AT-bus card with 1MB of on-board memory, a 15-pin VGA connector, five DIP switches, and a single jumper. It also has a Video Electronics Standards Association (VESA) feature for connection to a second graphics adapter. The DIP switch settings coordinate the adapter with common monitor timing signals at 800-by-600 and 1,024-by-768 resolutions. The jumper adjusts the board to operate at zero wait states with compatible motherboards. The DIP switches and jumper permit the card to operate with a wide range of monitors and motherboards.

EASY INSTALLATION

Installation is straightforward. Western Digital supplies drivers for Windows 3.0 and 3.1, OS/2, *AutoCAD*, *Microsoft Word* 5.0, and *WordPerfect* 5.0 and 5.1. Switching among Windows drivers is controlled by the WDSETUP program rather than by the Windows setup program. WDSETUP has its own Windows program group.

The complete documentation is illustrated with accurate line drawings. It explains hardware and software installation and summarizes the technical specifications for the card.



At $349, Western Digital's Paradise Accelerator Card for Windows is a relative bargain.

The megabyte of memory on the Paradise Accelerator Card is enough for it to operate at 800-by-600 resolution with 32,768 colors, 1,024-by-768 with 256 colors, and 1,280-by-1,024 with 16 colors. Its performance under Windows offers modest improvements compared with straight Super VGA cards and falls a bit short compared with slightly more expensive graphics accelerators such as the $445 Diamond Stealth and the $599 ATI Graphics Vantage.

The WD90C31 is a typical Windows accelerator graphics chip. It combines Super VGA compatibility with the bit-block transfer (BitBlt) and line-drawing operations most frequently used by Windows software.

If you are looking to step up from an older VGA or Super VGA card and you want higher resolution or 32,768 colors, the Paradise Accelerator is a fairly responsive graphics adapter that won't bust your budget. Other Windows accelerators offer better performance but at slightly higher prices. ■

List Price: Paradise Accelerator Card for Windows, $349 (with 1MB DRAM). Western Digital Corp., 8105 Irvine Center Dr., Irvine, CA 92718; 714-932-5000.

CIRCLE 433 ON READER SERVICE CARD

Can You Spot The One Computer We Don't Protect from Viruses?

Central Point Anti-Virus™ protects the 486s in engineering, the laptops in marketing, the XTs in your secretarial pool and just about everything in between.

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MICROSOFT WINDOWS COMPATIBLE

PC MAGAZINE EDITORS CHOICE

Oct. 29, 1991
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We have an award-winning program for DOS, a new version for Windows, even one for all your Macs. They not only destroy over 1,000 known viruses, they detect unknown viruses by looking for suspicious activity.

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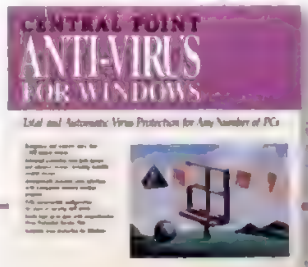

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Central Point Software

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CIRCLE 079 ON READER SERVICE CARD

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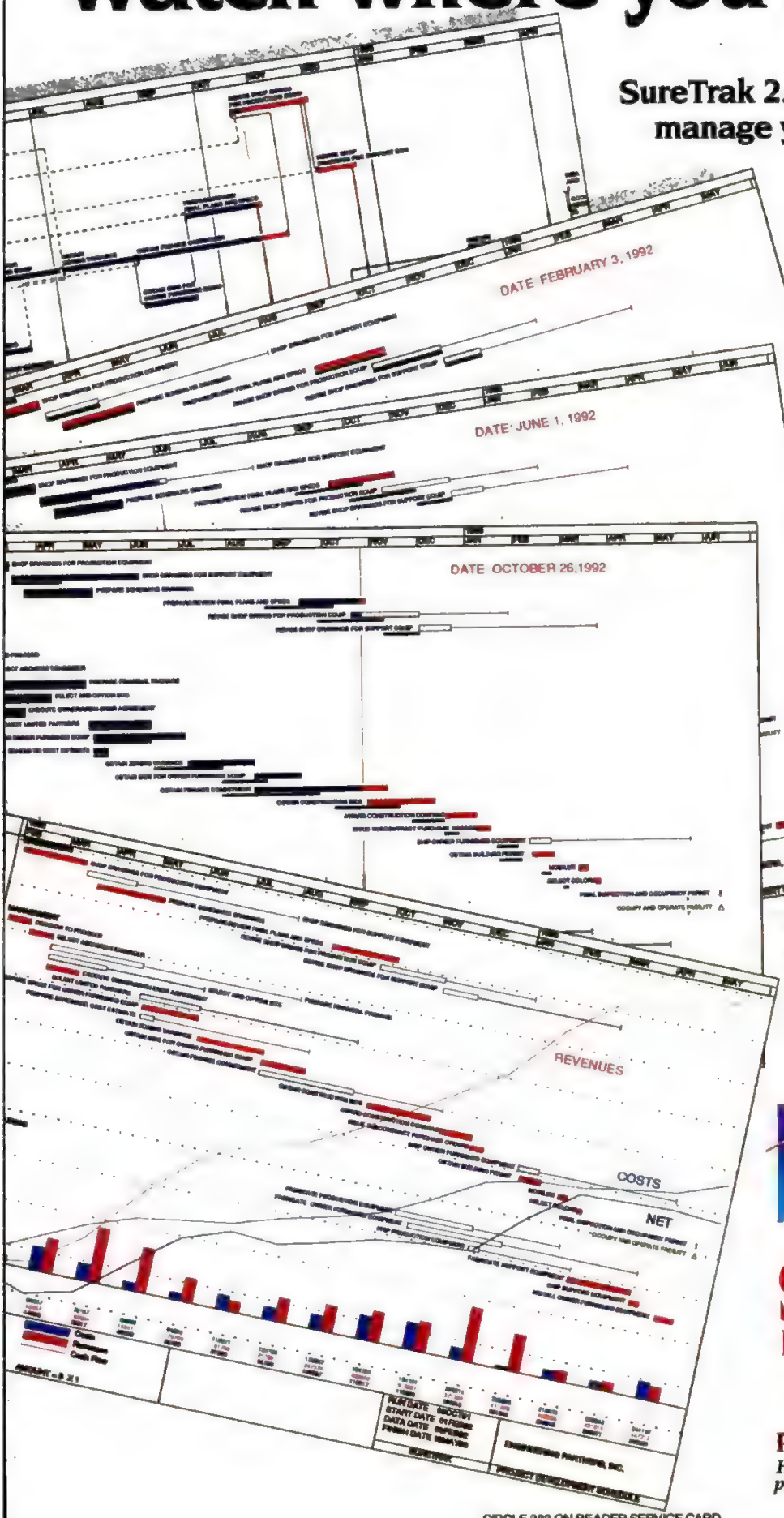
Watch where you're going!



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Creating schedules is one thing—and SureTrak does it with ease.

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CIRCLE 383 ON READER SERVICE CARD

by Emerson Andrew Torgan

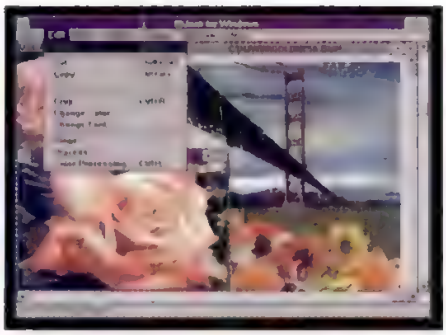
New & Improved

News of Announced Products and Upgrades

HiJaak for Windows Shakes the DOS Interface Blues

NEW **Inset Systems'** DOS-based *HiJaak* contains powerful graphics file conversion algorithms buried beneath an obtuse interface. *HiJaak for Windows,* Version 1.0, takes full advantage of the Microsoft Windows environment and has a more intuitive graphics utility, making file conversion and enhancement more accessible to users.

HiJaak for Windows supports more than 60 graphics file formats for viewing and conversion, including 15 vector, 23 raster, and 24 fax formats. File conversion becomes as simple as opening a file in one format and then saving it into another format. Viewing capabilities include use of fixed or dynamically variable palettes for 256 color displays, support for Windows' Multiple Document Interface (MDI) for viewing multiple images simultaneously, and color-reduction choices for dithering, diffusion, and halftones.



***HiJaak for Windows* provides easy access to powerful file conversion algorithms and color processing techniques.**

The package offers image capture in both DOS and Windows and processing functions that include scaling, rotation, palette optimization, histogram equalization, and control of brightness, contrast, and gamma correction. *HiJaak for Windows* supports OLE (object linking and embedding), drag-and-drop viewing and printing from the File Manager, and font remapping including TrueType support for Windows 3.1.

List Price: *HiJaak for Windows,* Version 1.0, $249. Inset Systems Inc., 71 Commerce Dr., Brookfield, CT 06804; 800-828-0068, 203-740-2400.

CIRCLE 402 ON READER SERVICE CARD

Central Point Offers A Faster "Commute" To the Office

IMPROVED **Central Point Software** is now shipping an enhanced version of its remote computing application, *Central Point Commute,* Version 2.0, that reduces the amount of data and time necessary for screen updates. Instead of a full transfer of information on every bitmap and pixel on the host display, the new version taps into the host PC's video device driver, capturing and transmitting more concise Windows graphics commands than previous versions did.

Providing remote-control access and file transferring under both DOS and Windows, *Commute* uses new video and data compression algorithms to speed the performance for both graphics and text applications, according to the company. A new file-transfer interface displays directory trees and file lists for both the host and remote PCs and features pull-down menus identifying previously transferred files. The package's memory management uses high, extended, or expanded memory in order to preserve conventional memory. Network support has been expanded to include NetBIOS-compatible LANs.

List Price: *Central Point Commute,* Version 2.0, $129. Central Point Software Inc., 15220 NW Greenbrier Pkwy., #200, Beaverton, OR 97006; 800-445-4208, 503-690-8090.

CIRCLE 403 ON READER SERVICE CARD

Direct Access Now Available for Windows

IMPROVED For those of you who are still confused by the Windows interface, **Fifth Generation Systems** has unveiled a Windows version of its popular DOS-based menuing software package. *Direct Access Windows,* Version 1.0, offers automatic icon-based menu configuration of Windows and DOS applica-

CONTINUES ON PAGE 60

HOT PROSPECT

IBM DEBUTS NEW PORTABLES: LARGE-DISPLAY COLOR LAPTOP, SLC-BASED NOTEBOOK

IBM's first entry into the color laptop marketplace, the PS/2 Model CL57 SX, has a 10.4-inch active-matrix color display and carries a surprisingly competitive price tag of $5,995. The 11-pound laptop features a 386SX processor running at 20 MHz, 2MB RAM (expandable to 16MB), and an 80MB hard disk. It has a full-size PS/2-style keyboard and an integrated trackball.

The CL57 SX's active-matrix TFT screen, the largest of its kind in the industry, according to IBM, is larger than the 9.5-inch screen of NEC's identically priced UltraLite SL/25C. However, the 386SL-based NEC is both lighter and faster.

Big Blue seems determined to get a piece of the highly competitive and ever-changing notebook market with two 6.2-pound units. The entry-level N51 SX, a 386SX-based notebook PC running at 16 MHz, is priced lower than the Compaq LTE 386s/20 and the Toshiba T2200SX. The soon-to-be-shipping N51 SLC, which uses IBM's 386SLC processor running at 16 MHz, promises to offer the same performance as a 386SL processor running at 25 MHz. The N51 SLC, priced at $3,295, is less expensive than Compaq's 25-MHz LTE/Lite 25 and Toshiba's T3300SL.

The competitively priced CL57 SX with its large active-matrix display is proof of IBM's determination to gain a foothold in the laptop market.

List Price: IBM PS/2 Model CL57 SX, $5,995; IBM PS/2 Model N51 SX, $2,250; IBM PS/2 Model N51 SLC, $3,295. IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; 800-772-2227.

CIRCLE 401 ON READER SERVICE CARD

BRIEFS

UTILITIES

Brown Bag Software is shipping *PowerMenu* ($54.95), a scaled-down version of its *PowerMenu Plus* program. It includes a menu system and file manager but no virus-detection or modem communications features. 800-879-7899, 408-559-4545.

CtrlAlt Associates is shipping *Stackey/Batutil*, Version 4.0 ($49). *Stackey* is a keyboard stacker with scripts that send keystrokes to running applications. It has a new script recording feature and can branch on hotkeys. *Batutil*, an enhancement of the DOS batch language, now has its own language with branching, integer and date arithmetic, and string manipulation. 800-872-4768, 301-387-4500.

Kamel Software's automatic purge utility, *OptiFile*, Version 1.0 ($295), reduces the size of *AutoCAD* drawings by removing unused objects. *OptiFile* scans drawing files, looking for unreferenced and empty blocks, layers, and line types, and provides a list of the unneccesary components for the user. Entities not selected are automatically deleted. 407-366-1172.

T.A.L. Enterprises is offering *SoftwareWedge*, Version 4.0 ($129), and *SoftwareWedge for Windows*, Version 1.0 ($199). The DOS version captures data from a PC's serial port and transfers it to the DOS keyboard buffer, allowing you to read data from any RS-232 device into any DOS application. The Windows version transfers serial port data to Windows as either keystrokes or via DDE (dynamic data exchange), reading data from any RS-232 device into any Windows application. 800-722-6004, 215-763-2620.

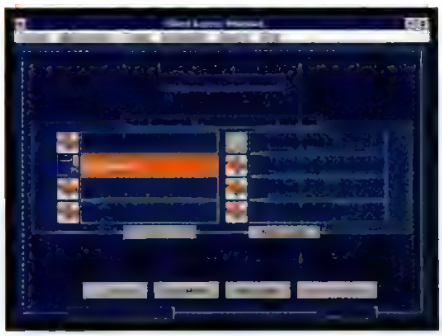
Vitesse has unveiled *Waves*, Version 1.0 ($29.95), for use with Windows 3.1 only. The collection of sound files includes gunshots, screams, and running water. *Perks*, Version 1.0, is a collection of eight utility programs for Windows 3.0 and 3.1, featuring a screen capture utility, a button launcher shell, a text editor, a laptop battery monitor, an alarm clock, a screen switcher, a

CONTINUES ON PAGE 64

CONTINUED FROM PAGE 59

tions in one convenient location, providing users with single-keystroke or mouse-click access.

The menu structure is customizable, letting users create up to six submenus, each with up to 36 items. Specific applications and menus can be password protected, and usage tracking of both DOS and Windows programs is available.



***Direct Access Windows* replaces the traditional Windows Program Manager with its own icon-based menu system.**

List Price: *Direct Access Windows*, Version 1.0, $99. Fifth Generation Systems Inc., 10049 N. Reiger Rd., Baton Rouge, LA 70809; 800-873-4384, 504-291-7221.

CIRCLE 404 ON READER SERVICE CARD

Microsoft Releases More TrueType Fonts For Windows

NEW **Microsoft Corp.** is offering a collection of 44 TrueType fonts designed specifically for the Windows environment. The *Microsoft TrueType Font Pack for Windows* supplements the 14 TrueType fonts that ship with Windows 3.1, providing true WYSIWYG capability with all Windows-based applications.

The pack consists of a core collection of 22 TrueType system fonts from Monotype Typography Inc. and 22 Lucida fonts from Bigelow & Holmes. The Lucida fonts provide a variety of text styles, as well as specific-use fonts for faxing and mathematical applications, according to the company. The font pack also supports Microsoft's font embedding technology, allowing Windows 3.1 applications to embed fonts in a document for transportation to another computer for reading and printing. Microsoft has integrated the TrueType rasterizer into Windows 3.1, assuring that TrueType will work with future versions of the operating environment and any applications.

List Price: *Microsoft TrueType Font Pack for Windows*, $99.95. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400.

CIRCLE 407 ON READER SERVICE CARD

VideoShow HQ: Multimedia to Go

IMPROVED **General Parametrics Corp.** has unveiled a 6-pound multimedia presentation system. The $4,999 VideoShow HQ utilizes input from VCRs, video cameras, tape and CD players, laserdisks, and presentation graphics software packages to create portable multimedia presentations that can include live video, stereo sound, animation, and graphics.

The 3.6- by 13.5- by 10.2-inch (HWD) unit features more than 120 transition effects, a 25-MHz RISC processor, 4MB RAM, and a 3.5-inch floppy disk drive. It is compatible with most monitors, video projectors, and LCD panels, according to the company. A number of optional sound, full-motion video, and image-capture boards are needed to create the most dramatic presentations.

List Price: VideoShow HQ, $4,999. General Parametrics Corp., 1250 Ninth St., Berkeley CA 94710; 800-233-0999, 510-524-3950.

CIRCLE 405 ON READER SERVICE CARD

ACT! for Windows: The Final Frontier?

NEW Contact management is serious business to **Contact Software International.** With different versions of *ACT!* available for the PC and the HP 95LX palmtop computer, it was only a matter of time before a Windows version of the popular contact management software appeared. The wait is over.

ACT! for Windows, Version 1.0, brings the same powerful contact database and search facilities, scheduling and calendar management functions, and report generation features to the Windows environment. It ships with predefined DDE (dynamic data exchange) macros providing links to Windows word processors and provides fax integration when a fax modem and software are present.

With *ACT! for Windows*, detailed contact records are a mouse click away.

List Price: *ACT! for Windows*, Version 1.0, $495. Contact Software International, 1840 Hutton Dr., #200, Carrollton, TX 75006; 800-365-0606, 214-919-9500.

CIRCLE 406 ON READER SERVICE CARD

See us at PC EXPO booth #4052

The 386SX with the lowest cost upgrade.

intel inside

The One & Only

Acer is the only company that lets you upgrade your 386SX computer to a 486 using a single chip. Others ask you to buy an upgrade module, costing $500-$1,000.

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There is alot of talk about upgrades... but the facts are that this AcerPower 386SX allows the lowest cost CPU upgrade on the market.

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To upgrade, just remove the cover, snap in the chip, replace the cover and turn on the power. Your 386SX automatically detects the new CPU to become a full-function 486 computer. All for the price of an Intel CPU chip, available from any electronics or computer store.

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"The AcerPower 386SX... boasts the least expensive upgrade trick yet."
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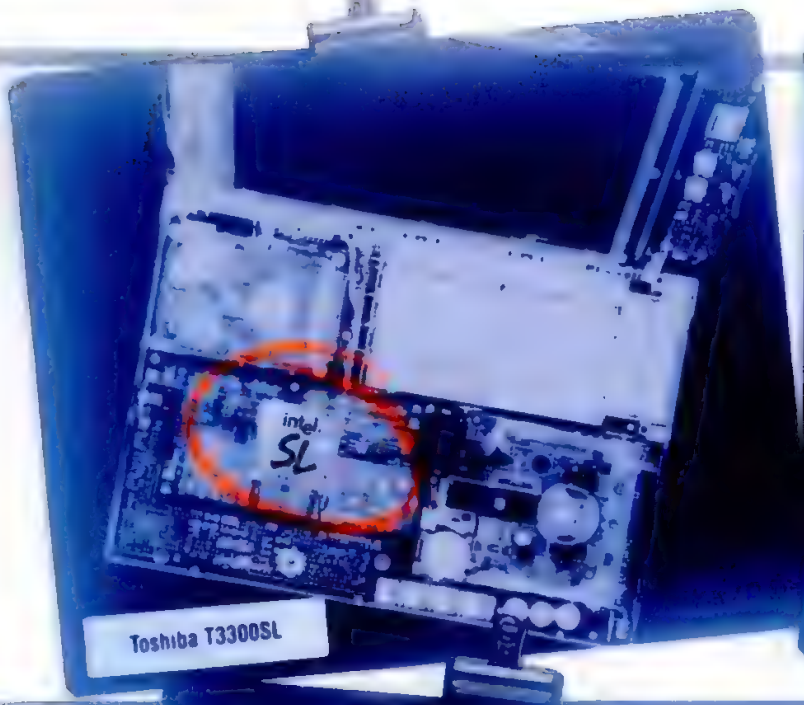

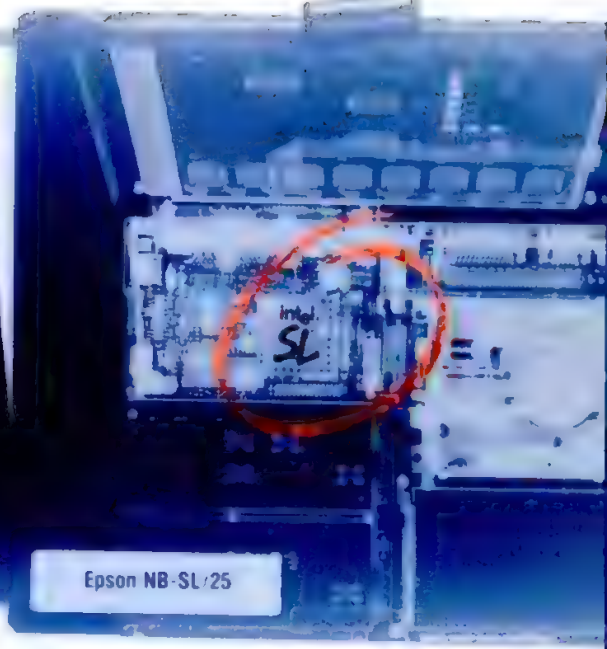

Look what's at the heart

intel inside

Take a closer look at some of the best notebook computers and it's easy to see why the prognosis is so good—they each have an Intel SL microprocessor. The Intel SL gives each of these unique notebooks a leg up, because it was designed specifically for the stop-and-go world of mobile computing.

For example, the Intel SL has an instant on/off feature that eliminates long boot-up and shut-down sequences. If you're interrupted, the Intel SL holds your place and puts your entire system into suspended animation, using virtually no

Battery Life*

Average 386 SX
4.8 hours

Intel386™SL
8.2 hours

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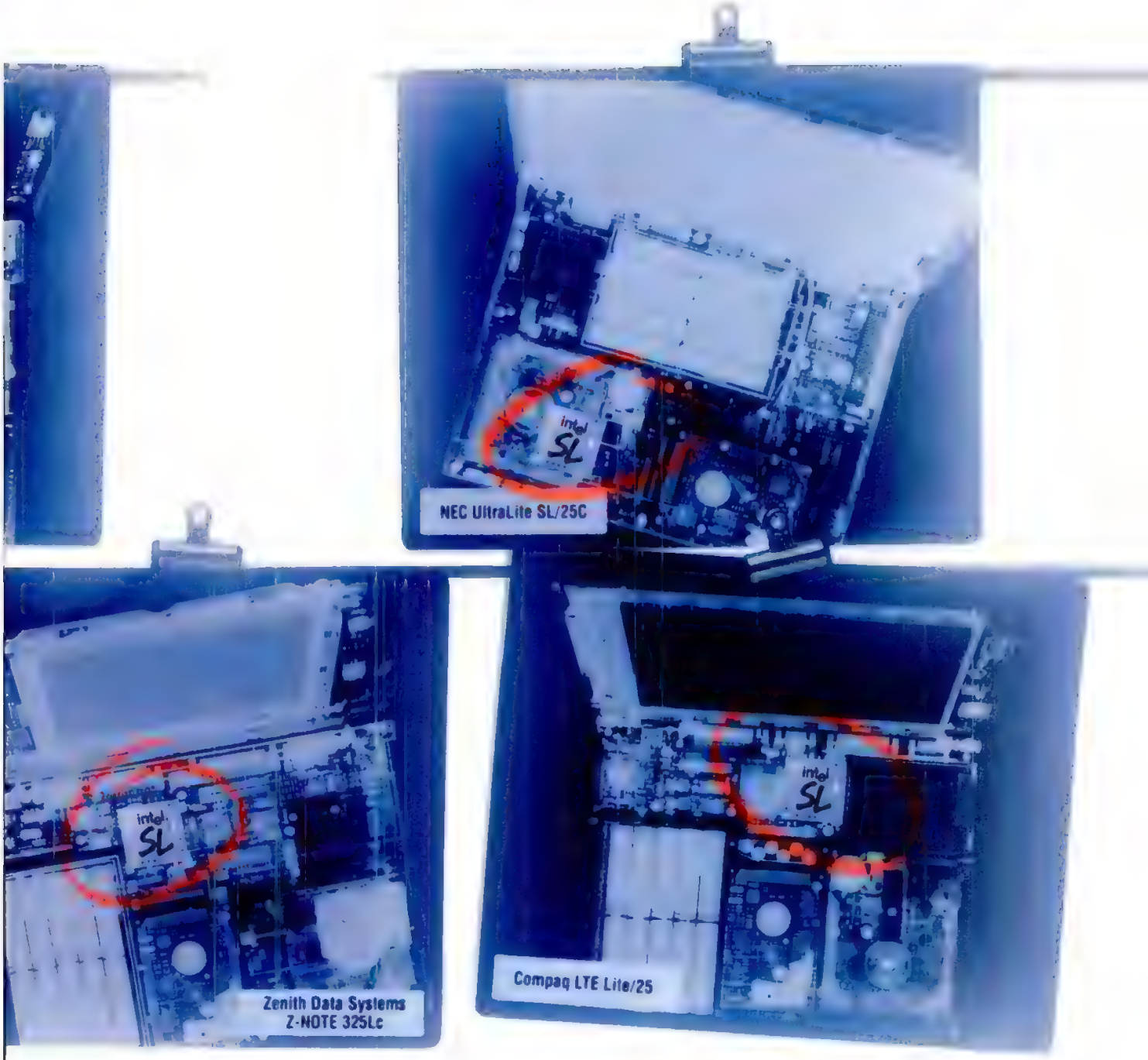


# of all the best notebooks.

power and significantly extending precious battery life.

The Intel SL is a more highly-integrated microprocessor, which means lighter, more feature-rich notebooks that come in speeds up to 25 MHz. No wonder major manufacturers are prescribing the Intel386™ SL microprocessor as a cure for traveling hassles.

Call 1-800-228-4549 to receive more information and a complete list of Intel SL-based notebooks.

Then watch for notebooks with the Intel SL. Because nothing else is worth looking into.

intel®

The Computer Inside.™

CIRCLE 266 ON READER SERVICE CARD

BRIEFS

CONTINUED FROM PAGE 60

memory tracker, and a blackjack game. 800-777-7344, 818-813-1270.

MONITORS

Everex is shipping the PRO Series of color monitors, available in 15-inch ($999), 17-inch ($1,799), and 21-inch ($3,199) models. The 15-inch model offers a noninterlaced resolution of 1,024 by 768, while the 17- and 21-inch models offer noninterlaced resolutions of 1,280 by 1,024 and interlaced resolutions of 1,664 by 1,200. All have flat, antiglare screens with a 72-Hz refresh rate. 800-628-3837.

Fora's Addonics MON-C172 17-inch color monitor ($1,495) offers 1,280-by-1,024 noninterlaced resolution and a 0.26-mm. dot pitch. It has a flat-square screen with an antiglare coating and a 72-Hz refresh rate. 408-944-0393.

Mitsubishi has unveiled three new color monitors: the Diamond Pro VGA ($638), the Diamond Scan 14 ($740), and the Diamond Pro 14 ($839). All feature an antiglare coating and a 0.28-mm. dot pitch. The Diamond Pro VGA offers 640-by-480 noninterlaced resolution. The Diamond Scan 14 offers 800-by-600 noninterlaced resolution and 1,024-by-768 interlaced resolution. The Diamond Pro 14 offers noninterlaced resolutions from 640 by 480 to 1,024 by 768. 800-843-2515.

Sampo is now shipping a new line of flat-screen color monitors offering 1,024-by-768 noninterlaced resolution at 70 Hz or 1,280-by-1,024 noninterlaced resolution at 60 Hz. The models are the AlphaScan 15 ($849), the AlphaScan 15E ($995), the AlphaScan 17 ($1,295), and the AlphaScan 17E ($1,495). The "E" series denotes low emission. 404-449-6220.

Toshiba has unveiled the P21CR00 ($3,499) 21-inch flat-square color monitor, which uses a dual parabolic voltage circuitry for enhanced focus, according to the company. The unit, designed to replace the PZICM00, offers a 0.31-mm. dot pitch and 1,280-by-1,024 noninterlaced resolution. 800-253-5249, 708-541-9400.

CONTINUES ON PAGE 66

Pacioli 2000 Ships "Easier-to-Use" $29.95 Upgrade

IMPROVED **M-USA Business Systems** is now shipping an update of its popular low-end accounting software, *Pacioli 2000*, Version 2.0. The program now includes support for laser printers and has a structure designed to make it easier for the novice user to handle.

A new "Account Class" browsing feature separates the various classes, such as accounts receivable and accounts payable. Templates are provided for creating new entries, users can import accounting transactions from ASCII text, and forms can be modified and exported to various word processors, spreadsheets, and database programs. The new version offers automatic reverse entries for monthly accruals, recurring entries for repeated transactions, and an enhanced report generator.

List Price: *Pacioli 2000*, Version 2.0, $49.95; upgrade from previous version, $29.95. M-USA Business Systems, 15806 Midway Rd., Dallas, TX 75244; 800-933-6872, 214-386-6100.

CIRCLE 408 ON READER SERVICE CARD

Check It LAN Expands Network Support

IMPROVED **TouchStone Software**'s inventory and diagnostics program, *Check It LAN*, Version 2.0, now supports up to 250 users across Novell's *NetWare*, Version 3.*x*, networks. It also includes new virus-detection capabilities.

Check It LAN monitors all hardware and software installed across a network, performs hardware diagnostic tests at user defined intervals, and has network-server status monitoring. It collects data on the type of processor, coprocessor, hard disk, and installed network interface card in use at each workstation as well as the number of ports and floppy disk drives. The program can also identify the DOS version in use and recognize more than 2,500 software applications. Prices range from $249 for the 5-node version, to $1,995 for the 250-node version.

List Price: *Check It LAN*, Version 2.0, $249 (five-node version). TouchStone Software, 2130 Main St., #250, Huntington Beach, CA 92648; 800-531-0450, 714-969-7746.

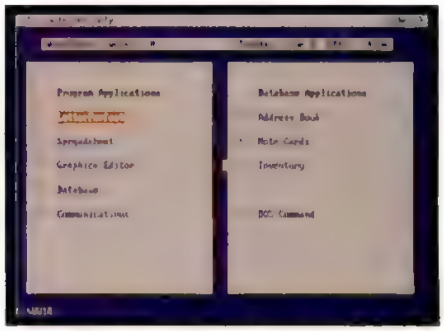
CIRCLE 409 ON READER SERVICE CARD

Integrated Software: Both the New and the Improved

NEW **WordPerfect Corp.**'s first entry into the integrated software market combines all the standard features users have come to expect from an integrated package, with a low price tag of $159. *WordPerfect Works*, Version 1.0, includes the *LetterPerfect* word processor (a scaled-down version of *WordPerfect*), a flat file database, a graphics editor, a spreadsheet, and a communications package.

All *Works* applications have pull-down menus and context-sensitive help, and they are all linked by a customizable "run" menu, letting users switch applications without exiting to the shell menu. Files from the word processing, graphics editor, and spreadsheet applications are fully compatible with WordPerfect's *WordPerfect* 5.1, *DrawPerfect* 1.1, and *PlanPerfect* 5.1.

Enable Software's updated integrated software package, *Enable*, Version 4.5, now includes support for *Higgins* LAN-based e-mail, group scheduling, and groupware applications. A new installation feature lets users install individual modules. *Enable* offers the standard word processing, database, graphics, spreadsheet, and communications modules typical of integrated packages, as well as desktop accessories such as a calculator, card file, calendar, clock, and telephone directory.



WordPerfect Works: **No fancy menus or multimedia help extensions, just the standard applications at a good price.**

List Price: *WordPerfect Works*, Version 1.0, $159. WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; 800-451-5151.

CIRCLE 410 ON READER SERVICE CARD

List Price: *Enable*, Version 4.5, $795. Enable Software Inc., 313 Ushers Rd., Northway Ten Executive Park, Ballston Lake, NY 12019-1519; 800-766-7079, 518-877-8600.

CIRCLE 411 ON READER SERVICE CARD

Fig.P 6.0 Offers Scientific Graphing in DOS

IMPROVED **Biosoft** is shipping an update of its scientific graphics and analysis package with an integrated oversize spreadsheet featuring transformation, reorganization, and statistical capabilities. *Fig.P*, Version 6.0, supports worksheet file formats from *Lotus 1-2-3* (including .WK3) as well as *Symphony* and *Quattro Pro*.

CONTINUES ON PAGE 66

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BRIEFS

CONTINUED FROM PAGE 64

ViewSonic's 15-inch flat-square 6FS ($799) offers a 0.28-mm. dot pitch and a noninterlaced resolution of 1,024 by 768. 800-888-8583, 310-946-0711.

NOTEBOOK PCs

Aquiline is now shipping the Aquiline NT33 ($3,999), a 386DX-based unit running at 33 MHz. It features a 170MB hard disk and 16MB RAM. 802-442-1526.

Micro Express is shipping the NB2500 ($2,695), a notebook PC based on AMD's AM386DXL processor running at 25 MHz. The unit has an 80MB hard disk and 4MB RAM. 800-989-9900, 714-852-1400.

Twinhead is shipping three new slim notebooks, including the Slimnote 486DX/33 ($3,499). The 486DX-based unit runs at 33 MHz and features an 80MB hard disk drive and 4MB RAM. Also available are the Slimnote 486SX ($2,999) and the Slimnote 386SXL/25 ($2,399). 800-545-8946, 408-945-0808.

Datamedia is offering SECUREcard/100 ($95), a security software package for portable PCs that acts much like an automatic teller machine card. During installation, the software formats a 3.5-inch floppy disk as a "token" that must then be inserted each time users boot up the system. A user-defined password is also set during installation. 603-886-1570.

Telebyte Technology's Model 701 Pocket Videoverter ($399) converts the VGA signals of portable PCs to the NTSC format required by standard television monitors and VCRs, allowing a TV screen to act as a color display. The Model 701P converts to the European PAL format. 800-835-3298, 516-385-3232.

Tidal Technologies is shipping the Tidal Parallel Pad ($79), a 17-key external numeric keypad that connects to the parallel port of a portable PC and provides a pass-through parallel port for printer connection. Tidal is also offering the Tidal RoadPower Voltage Converter ($119), letting users run portable PCs and peripherals from a car cigarette lighter. 800-538-1199, 510-748-7272.

CONTINUED FROM PAGE 64

According to Biosoft, the new version has enhanced file support for ASCII data, multiple dataset file retrieve options, and math coprocessor support. Additional new features include single-X/multiple-Y data-transfer options from the integrated spreadsheet to datasets, confidence band options for graphing curve-fits, and a hotkey browser on the main menu.

List Price: *Fig.P*, Version 6.0, $499. Biosoft, P.O. Box 10938, Ferguson, MO 63135-9913; 314-524-8029.

CIRCLE 417 ON READER SERVICE CARD

Software Bridge Eases The Windows Transition

IMPROVED **Systems Compatibility Corp.**'s *Software Bridge*, Version 5.1, has a new Windows installation function and new file-conversion options for Windows word processors such as *WordPerfect for Windows* and *Microsoft Word for Windows*. The package converts files from more than 60 word processing, database, and spreadsheet formats into 30 user-defined word processing formats while retaining the original formatting.

Text searching enhancements let users search complete directories for the occurrence of a specific string. *Software Bridge* ships with a .PIF file and icon for Windows users.

List Price: *Software Bridge*, Version 5.1, $149; upgrade from Version 5.0, $29.95. Systems Compatibility Corp., 401 N. Wabash, #600, Chicago, IL 60611; 312-329-0700.

CIRCLE 413 ON READER SERVICE CARD

HyperAccess/5 Improves File Transfers

IMPROVED **Hilgraeve** has unveiled *HyperAccess/5*, Version 2.1, an update of its asynchronous communications software featuring single-keystroke file-transfer options and a new Modular Communications Engine (MCE) technology that provides faster throughput rates. The package also has preprogrammed support for more than 160 specific modems, including high-speed V.32bis and V.42bis units.

HyperAccess/5 ships with a number of scripts for accessing systems such as MCI Mail and CompuServe, and it also has virus-detection and eradication features. The program's Zmodem file-transfer protocol now supports auto-download, saving keystrokes when receiving files from bulletin board systems. A new Zmodem Crash Recovery function lets users resume interrupted file transfers and reduce connection time.

List Price: *HyperAccess/5*, Version 2.1, $99.95; upgrade from previous versions, $29.95. Hilgraeve Inc., 111 Conant Ave., Suite A, Monroe, MI 48161; 800-826-2760, 313-243-0576.

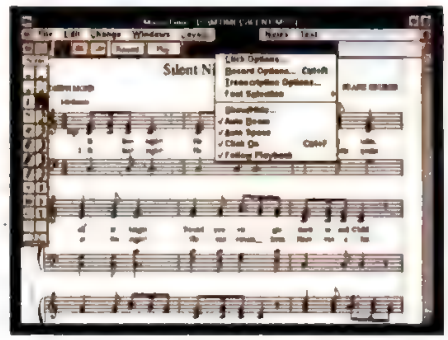
CIRCLE 412 ON READER SERVICE CARD

Compose, Record, Play, and Print Music In Windows!

NEW **Passport Designs** is shipping *MusicTime*, Version 1.0, for Windows and *Encore*, Version 2.5, for Windows. Both let users compose, notate, edit, and print sheet music.

MusicTime, based on *Encore*, is designed for amateur musicians and hobbyists. It can record music played on a MIDI-equipped instrument, and display it in standard musical notation on-screen. It offers dozens of music symbols, and editing features such as cut, copy, and paste, and click-and-drag techniques.

Encore, Version 2.5, now includes a "Frets" feature, a guitar chord font that has been added to the software's graphics palette. "Frets" lets users place standard guitar fret diagrams within the score. The new version also ships with the *Adobe Sonata* screen and laser printer fonts and *Adobe Type Manager*, Version 2.0.



Through a supported sound card, *MusicTime* will play your compositions.

List Price: *MusicTime*, Version 1.0, $249; *Encore*, Version 2.5, $595. Passport Designs Inc., 100 Stone Pine Rd., Half Moon Bay, CA 94019; 800-443-3210, 415-726-0280.

CIRCLE 415 ON READER SERVICE CARD

WindFORM: Windows Forms Processing and Printing

NEW **Ibis Software** is shipping *WindFORM*, Version 1.0, a forms-design package for Windows 3.0 and 3.1. The new offering lets users create custom designs, import forms from existing forms-design and desktop publishing packages, or choose from a library of 150 predesigned forms.

Rules and grids can be displayed in inches, centimeters, points, or picas. Reference lines can be superimposed over forms to aid in text alignment, and a snap-to grid function aligns graphics objects. ■

List Price: *WindFORM*, Version 1.0, $179.95. Ibis Software Inc., 140 Second St., #603, San Francisco, CA 94105; 415-546-1917.

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CIRCLE 040 ON READER SERVICE CARD

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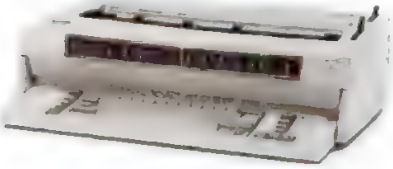

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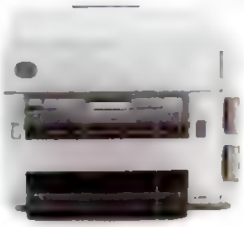
...and keyboards and other input devices.



... IBM laser, ink-jet and dot matrix printers...

But the praise that meant the most came from a customer. He told us, "The best thing about your new company is that I can just pick up the phone and call. I get answers. I get my problems solved. And I get back to business."

Which perfectly describes the company Lexmark is striving to be. Nimble. Customer-driven. A large company, managed as if it were small.

A company committed to making its mark by helping you make yours.

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Make Your Mark

CIRCLE 152 ON READER SERVICE CARD

CORELDRAW CD-ROM PACK

1 CorelDRAW 2.01 on CD-ROM

CorelDRAW is the world's finest graphics package! To date it has won over **50 international awards** for its incredible type control, superb drawing power, stunning special effects, and ease of use. Creating eye-catching newsletters, advertisements, presentations and illustrations is fast and fun with CorelDRAW. Our users love it!

- **Over 10,000 clipart images and symbols**: included from the libraries of the leading clipart companies in the industry. This clipart is uncompressed so that it can load up to 10 times faster than the diskette version.
- **Over 200 fonts**: with incredible type control!
- **Easy installation**: the entire program can run directly from CD-ROM, saving valuable space on your hard drive.
- **Multilingual**: 5 languages included on one disk English, German, Dutch, French and Spanish.
- **Multiplatform**: both Windows and OS/2 versions.
- **Hotline**: free demo program and unlimited hotline support.
- **On-line Help**: comprehensive documentation built into the program.

2 High Performance CD-ROM Drive

The Blockbuster Bundle is complete with one of the **fastest multimedia CD-ROM drives**, available in internal or external versions. Key features include embedded SCSI interface, head-phone output jacks, and adjustable volume control. And you can play all your favorite music CDs with the bonus CD-Audio software.

3 CorelSCSI Interface Kit

CorelSCSI provides a **fast and easy connection** to your PC allowing up to 7 peripherals on the same card. And it includes software drivers so you are ready for **future expansion** with other peripherals.
It includes:

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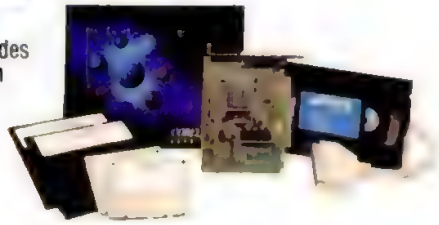

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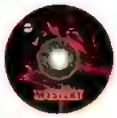

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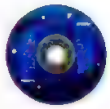

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by
Carol Levin

Read Only

Reviews of the Latest Books for the PC User

Accelerating PageMaker 4: Cool Techniques that Push It to the Limit

Aldus PageMaker has developed a well-deserved reputation as a high-quality desktop publishing program that is incredibly easy to use. It's ironic, but that same reputation often keeps users from delving deeper into the program's more sophisticated functions.

The authors of Bantam's *Real World PageMaker 4: Industrial Strength Techniques* have dug deeply into their combined experience to uncover real *PageMaker* gems. Authors Jesse Berst, Stephen Roth, Olav Kvern, and Scott Dunn all work in professional publishing. In fact, Kvern is the senior documentation designer at Aldus. You can be sure that they have encountered many real-world problems that inspired the real-world solutions presented in the book. The quality of the language is also a testament to their professional credits as journalists and editors. This computer book is actually fun to read.

Real World PageMaker 4 is logically organized—with chapters dedicated to words, pictures, printing, color, and workgroup publishing—and has detailed instructions and strong supporting visuals. Novice users who read the book sequentially will reap a twofold benefit. First, they'll get clear explanations of essential *PageMaker* features, such as story threads. Second, they will see how this program-specific information fits into the larger context of Windows-based desktop publishing.

For example, in the chapter on setting up the program, the authors also discuss Windows font technology and ancillary graphics utilities. They don't just tell you how to install *PageMaker*, they help you create an integrated publishing environment.

Tips and techniques such as these are the heart and soul of this book. You'll find commonsense advice, hidden power tools, and offbeat workarounds. Some of the more sensational suggestions include creating a text wrap that flows inside (rather than around) an irregularly shaped object, and using leading and kerning to produce unique logo designs.

On a more practical note, you can also discover how to create a named style by example: You can tweak text intuitively until it looks right, and then assign a style name. *PageMaker* will automatically pick up all of the character and paragraph formatting of the currently selected text.

The chapters on color and workgroup publishing are admittedly sparse, but this is a reflection of *PageMaker*'s nascent capability in these areas. If you're planning to work in color production or a networked environment, read these chapters for an honest look at *PageMaker*'s limitations.

Real World PageMaker 4 is a rare find among computer books. If you read it, follow the advice of its talented authors, and become proficient in its techniques, you will truly be an industrial-strength desktop publisher, with nothing to stand in your way.—*Luisa Simone*

Real World PageMaker 4: Industrial Strength Techniques
by Jesse Berst, Stephen Roth, Olav Kvern, Scott Dunn, $26.95, Bantam Books, 666 Fifth Ave., New York, NY 10103; 800-223-6834, 212-765-6500. ISBN:0-553-35264-4.
CIRCLE 474 ON READER SERVICE CARD

Network Managers' Handbook Dispenses First Aid for Popular LAN Architectures

A network manager's job description usually involves doing anything and everything necessary to keep the network up and running. Although there is no substitute for hands-on experience, *LAN Troubleshooting Handbook* by Mark A. Miller can help you fill in some knowledge gaps.

There are plenty of books that focus on the operating-system component of networks, but Miller tackles problems involving hardware and cabling issues that, as most LAN managers will tell you, make up the majority of their problems. For starters, Miller explains the Open Systems Interconnection (OSI)—the model for computer communications protocols—and the family of LAN standards set by the Institute of Electrical and Electronics Engineers (IEEE). He follows with the often-neglected but vital topic: documenting your network. There are sample forms to document just about every aspect of your LAN, from cabling-system worksheets to Token-Ring network planning forms.

To prepare for network emergencies, Miller says to keep a library of technical material, a list of people who can serve as resources, and drawings of network topology and workstations. And to help you assemble a toolkit of test equipment, there's a chapter with photographs and descriptions of devices, including cable scanners and fiber-optic test kits.

The *Handbook* then moves to the main topic: troubleshooting. A general chapter on isolating and solving cable-system failures leads to the second half of the book, which is devoted to specific network cabling architectures: ARCnet, Token-Ring, coaxial Ethernet, StarLAN, and twisted-pair Ethernet. For each type, Miller offers detailed information and checklists to assist you in diagnosing and resolving problems. A disk of shareware programs for diagnosing LAN faults is available.

Miller's *LAN Troubleshooting Handbook* is a good resource for LAN managers who want a better understanding of the technical aspects of LANs from a hardware point of view.—*Wendy Dugas Pérez*

LAN Troubleshooting Handbook
by Mark A. Miller, $29.95 ($39.95 with disk), M&T Books, 411 Borel Ave., #100, San Mateo, CA 94402-3522; 800-533-4372, 800-356-2002. ISBN: 1-55851-056-7.
CIRCLE 475 ON READER SERVICE CARD

Introducing the first notebook computer designed to make Windows™ a breeze.

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TEXAS INSTRUMENTS

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CIRCLE 304 ON READER SERVICE CARD

Software Guides Cut to the Basics With Easy Instructions for New Users

Need ready information on the DOS 5.0 EXE2BIN command? How about help with editing *WordPerfect* macros or Windows' terminal emulation? If you are one of the many PC users who need answers to *none* of these questions, yet you need a working knowledge of popular applications, then Online Press's *Quick Course* series may be just what you need.

While many computer books claim to be the last word on programs, the *Quick Course* series intends solely to get you up and running. Online Press offers seven books in the series, including guides to DOS 5.0, Windows 3.0, *WordPerfect for Windows*, and *Excel for Windows*. Each $12.95 guide is less than 150 pages long and has large type and a perfect-bound spine so you can lay it flat as you're working at your PC.

One strength is this series's focus on what a user typically wants to do—not just what the program will do. Each book consists of six chapters of step-by-step instructions and, for the inquisitive, frequent pointers that go into more detail. They are also perfect to help groups of new users become productive quickly.

A Quick Course in DOS, Version 5, by Joyce Cox and Kjell Swedin (ISBN: 1-879399-03-2), starts with DOS's essentials and proceeds in surprising depth and clarity through the DOS Shell, batch files, task switching, common error messages, and even programs like HIMEM and SMARTDRV. There's also a handy table of commands for common tasks.

Salley Oberlin and Patrick Kervran's *A Quick Course in Windows, Version 3* (ISBN: 1-879399-00-8), spends too much time on Windows games (as do we all), but the remainder is all you need to be productive. Chapter topics include Windows conventions, organizing files and programs, multitasking, data sharing, and utilities.

A Quick Course in WordPerfect for Windows, by Kaye Fox, Polly Urban, and Marilee Richins (ISBN: 1-879399-06-7), presumes some Windows proficiency in its aim to deliver to *WordPerfect for DOS* users as well as new users all the basics, from navigating in the program through formatting documents, creating professional reports, incorporating graphics, and merging files for form letters and envelopes.

A Quick Course in Excel for Windows, by Joyce Cox and Patrick Kervran (ISBN: 1-879399-04-0), has the toughest job, thanks to *Excel* 3.0's breadth. But for the 20 percent of the spreadsheet that most people use, you'll find what you need.

What the *Quick Course* books don't cover are topics Online Press believes novice readers don't need to know, at least at first. These guides will help you come up to speed and do some work.—*Ed Perratore*

Quick Course Series
$12.95 each, Online Press Inc., 14320 NE 21st St., #18, Bellevue, WA 98007; 800-854-3344, 206-641-3434.
CIRCLE 476 ON READER SERVICE CARD

MEMORY LIMEMS HMA DOS 5.0 XMS BUFFERS UMB BLUEMAX QUALITAS 386MAX 486SX DRIVERS 386SX NETWORKS TSRs C&T 286

The best performance in memory.

We can't remember the last time one memory manager earned as much praise from so many experts as new 386MAX® 6 from Qualitas.

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PC MAGAZINE EDITORS' CHOICE February 11, 1992 386MAX Version 6.0

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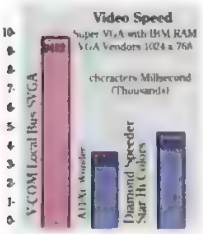

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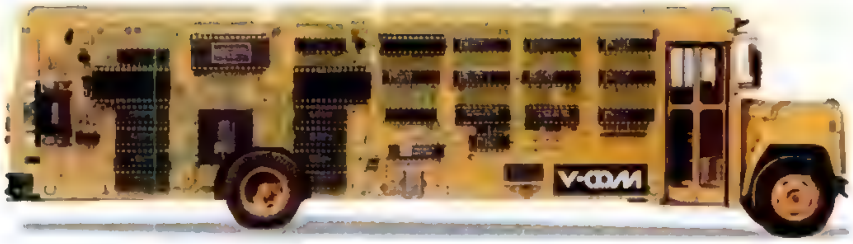

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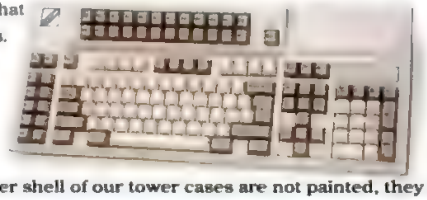

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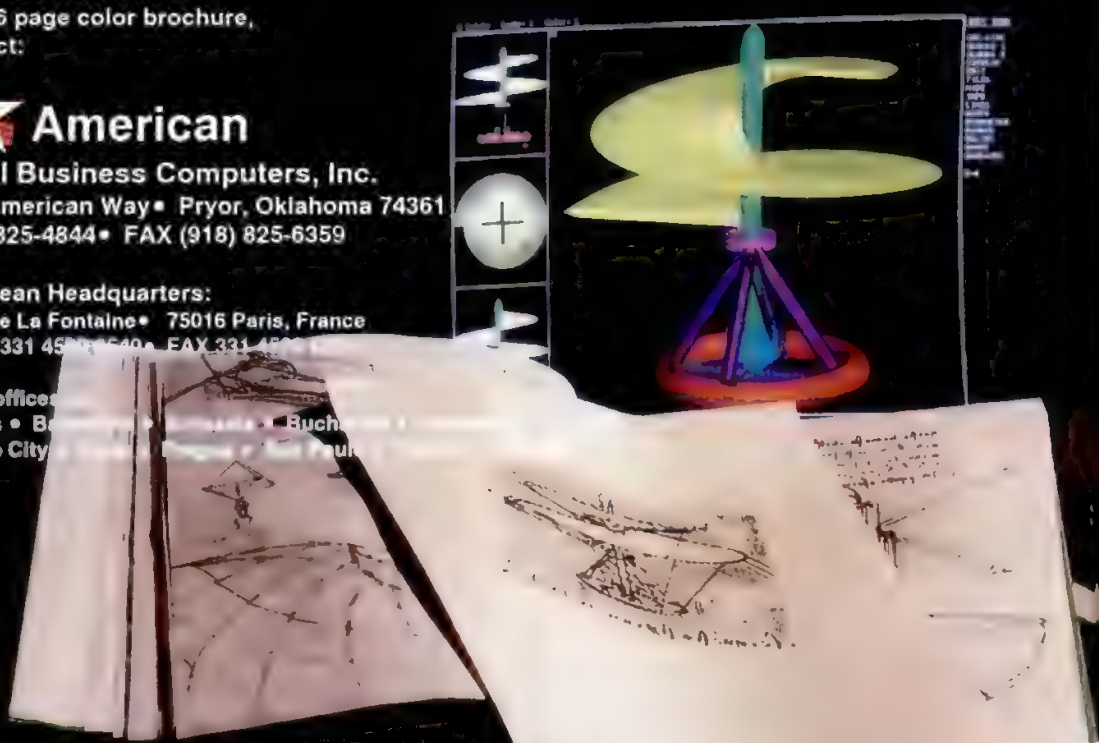

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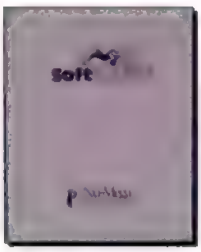
Toolkits

Reviews of the Latest Tools for the PC Programmer

Soft-ICE/W: A Must For Serious Windows Debugging



Writing Windows programs isn't easy, but debugging them is a colossal pain. Nu-Mega Technology's Soft-ICE/W improves the Windows debugging process. Where most debuggers concentrate on debugging a program as an isolated block of code, Soft-ICE/W debugs your program as an integrated Windows unit.

Soft-ICE/W is a TSR, so you load it before running Windows. Once Soft-ICE/W is resident, not only is it available at the press of a user-definable hotkey, but it also is ready to catch those intermittent UAEs (Unrecoverable Application Errors), which can be incredibly difficult to track down.

You can use Soft-ICE/W to debug individual Windows programs. Applications and DLLs can be loaded with symbolic information (in CodeView format) to provide source-level debugging. And since Soft-ICE/W is resident when Windows is launched, it is the perfect vehicle for debugging Windows device drivers and Enhanced-mode VxDs (Virtual Device Drivers).

While some debuggers can provide a dump of 32-bit assembler code and others can use symbolic information to label VxD service calls within that code dump, Soft-ICE/W disassembles VxDs and labels the service calls without using symbolic information. Calls to the Windows API are also automatically labeled. In addition, Soft-ICE/W can debug DOS programs while they run in a DOS box. This can be quite handy for debugging TSRs where bugs usually lock up the machine.

The power of Soft-ICE/W, though, lies in its ability to debug a program at any protection level of the machine. Soft-ICE/W can trace code in a DOS box, in 16-bit protected-mode segments, and even in the flat 32-bit addressing modes used by Windows VxDs. The full effect of this multimode trace capability can be seen by using Soft-ICE/W to trace an interrupt routine from its initial handler in a VxD to any interrupt hooks in protected mode, and finally to a real-mode interrupt handler in a DOS V86 box.

Soft-ICE/W provides a host of breakpoint options. You can set breakpoints on interrupts, memory ranges, I/O port accesses, Windows messages, and execution ranges. You can also program them to break conditionally and after a pass count. For example, you can set a breakpoint to trigger not only on receipt of a specific message, but on receipt of that message sent from a specific window as well.

Memory can be addressed in a number of ways. Both 16- and 32-bit segments can be examined and changed simply by addressing the segment using a valid selector. Valid selectors can be listed using the LDT and GDT commands to dump the Local Descriptor Table and Global Descriptor Table, respectively. DOS real-mode segments can be addressed by prefacing the memory segment:offset address with the & character.

Soft-ICE/W has a number of commands for monitoring the machine environment. It can list the Windows API entry points, the task queue, the local and global heaps, the VxD map, and the Windows module list. Other commands dump the LDT, GDT, and IDT (Interrupt Descriptor Table) contents, the page table map, the 80386 control registers, and the Task State Segment.

Soft-ICE/W's on-line help system conveniently displays all available commands and their syntax. In addition, its documentation is sprinkled with notes about how Windows works. This can be particularly helpful if you're tracing through Windows code and run across an unusual programming technique. For example, it might be slightly disconcerting to see the Windows code jump into a segment filled with HLT (halt) instructions! But reference Nu-Mega's manual, and you'll find it explained: Windows code uses an array of HLT instructions to change from V86 mode to protected mode inside Windows.

> The power of Soft-ICE/W lies in its ability to debug a program at any protection level of the machine.

The user interface Soft-ICE/W employs emphasizes function over form. The debugging screen is Spartan, lacking features such as pull-down menus, overlapping windows, and even mouse support. If you're expecting a snazzy interface like Turbo Debugger, you will be disappointed by the Soft-ICE/W interface.

The screen looks similar to a CodeView screen, with windows for registers, memory, code, watch variables, and commands. Windows can be sized but not moved. And while Soft-ICE/W can use 50-line mode with a VGA, individual windows are limited to 25 lines in height. The function keys are user-definable, defaulting to the standard CodeView configuration. As you would expect from a Windows debugger, Soft-ICE/W runs in a full-screen text window, although a second screen or a remote PC via a serial port is supported.

Soft-ICE/W is not without its shortcomings. Since Soft-ICE/W runs only in 386 Enhanced mode, you can't debug applications running in Standard mode. Also, Soft-ICE/W is almost too good at tracing code: I asked for a breakpoint on an interrupt in a DOS box and Soft-ICE/W disabled a Windows VxD, since that is where the interrupt is initially handled. Fortunately, the manual provides some hints on how to avoid these situations.

All in all, Soft-ICE/W is one of those truly neat programs that come along once in a while. By the time you read this, its Windows 3.1–compatible version will be available. So while you may chose to keep your own favorite debugger for simple work, Soft-ICE/W will soon become mandatory equipment for serious Windows debugging.

—*Douglas Boling*

Soft-ICE/W, Version 1.0
List Price: $386. **Requires:** Windows 3.0, 386SX PC or better, 256K RAM free with Windows running. Nu-Mega Technologies Inc., P.O. Box 7780, Nashua, NH 03060-7780; 603-889-2386.

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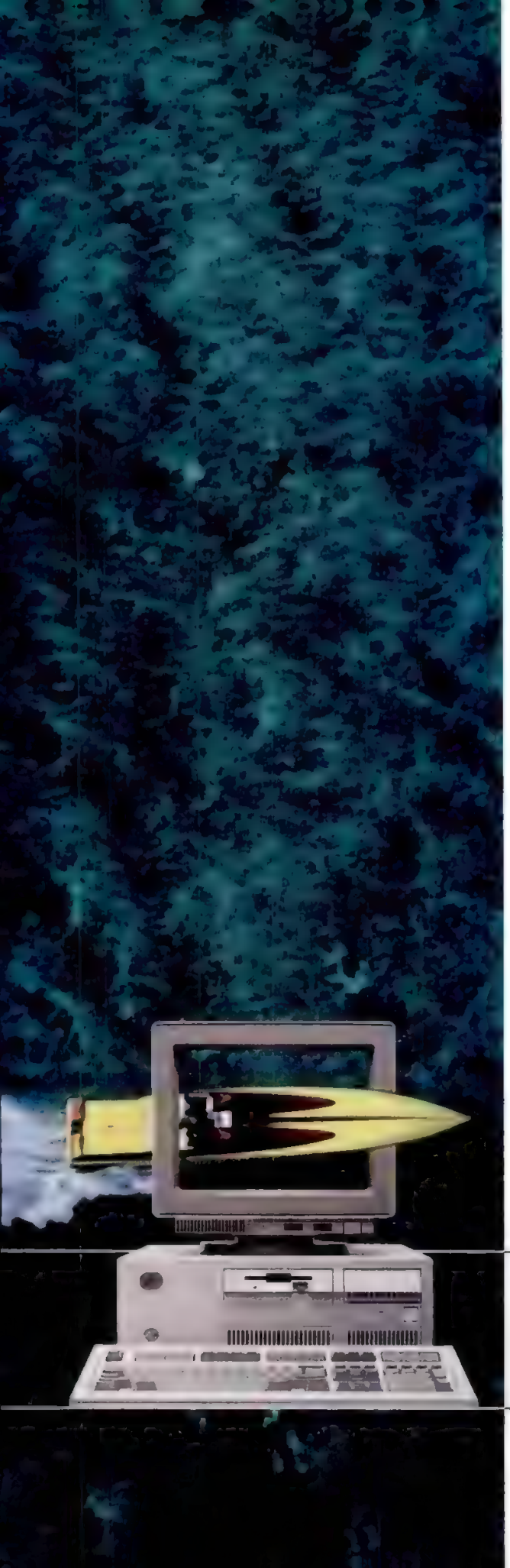

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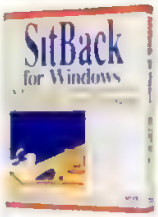

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Michael J. Miller

Software as Building Blocks

Tomorrow's applications will be created by personally customized programs assembled from reusable building blocks of code.

Instead of creating big, monolithic applications, more and more software developers are concentrating on smaller components that fit together to create larger apps. These could become the building blocks of future, more personal applications. For this to happen, though, the industry must address a variety of programming, distribution, and support issues.

As we move toward more modular software, the whole system is eventually reduced to a collection of *objects*. Many of today's commercial applications are now created out of many smaller objects using programming languages such as C++ — effectively programming code that can be easily adapted and reused. At the next level of complexity, users can embed one object into another through techniques such as OLE (object linking and embedding). Somewhere in the future, we'll see the operating system track and manage objects—combinations of data and programs stored in different places within the system.

If everything works, you should be able to take these components and create an application that works the way you do, rather than the way some programmer wants it to. Instead of using individual applications such as a word processor, spreadsheet, or communications program, you would use a personal application, perhaps built out of today's familiar tools.

The big question is: How will all these components be assembled?

The obvious answer is the mega-application, which will look just like the applications we know today. For example, today's mega-word-processing package comes with its own spell-checker, grammar checker, thesaurus, and equation editor, as well as drawing tools, charting tools, mail-merging tools, and who knows what else. Although nobody uses all the features of these mega-apps, the system makes sense for the industry. Competitive pressures spur developers to include more and more features, which become crucially important in the corporate setting. If an average individual uses only 20 percent of an application, that's okay. In a workgroup, perhaps 50 percent of the features are used, and in a large company, maybe 95 percent. Since it is easier to support fewer products, this approach has a lot going for it.

If we're not careful, though, all of these new features might result in an impossible array of complexity for the end user. Developers need to place at least an equal emphasis on making their products easier to use.

EVERYMAN'S INTERFACE

One way to protect against unnessary software complexity is customization. Every major new Windows application has added what are essentially preprogrammed shortcut menus. In most of today's programs, you can customize these toolbars (or Button Bars, Smart Icons—whatever the company has named them), adding new macros or commands. In many cases, you can edit these programs' menus, too, by assigning new macros, commands, or even other programs to your menus. You create the user interface that works best for you.

For software to be really personalized, we'll need a cross-application macro language, such as the one under development at Microsoft.

That user interface must be able to control data created and used by a variety of applications, each of which becomes just a tool in our new application. OLE is one step in the right direction, although it must become much easier

to use before it is truly useful. Customized interfaces will facilitate *compound documents,* where we edit text, spreadsheet data, charts, and graphics seamlessly. We'll work within the context of just one application, since we'll be unaware that we're changing applications. For this to work really well, we'll need a cross-application language that makes it easy to pass both data and commands from one app to another. Microsoft, Apple, and others are now working on such languages.

Tying applications together is important, but only if it's easy enough to do. One thing that leads me to believe it will get easier is the emergence of Hewlett-Packard's *agents* and Microsoft's *wizards.* Wizards are fairly simple; they walk the user through particularly complicated tasks. Wizards, like the ones in *Microsoft Publisher* that can help you lay out a basic newsletter, do much of the work for you. Agents, like those in *HP New Wave,* are more sophisticated and more general. You show them what to do; they watch you and do it. At a simple level, this can work like an intelligent macro recording feature. For instance, you could set up an agent that automatically downloads stock market data, puts it in your spreadsheet, and creates a graph every morning.

If all this works, we could see applications assembled and customized by function. For instance, a marketing department might want an application built out of a word processor, a graphics program, and a video source. A financial department might want an application built out of a spreadsheet with special database and statistical tools. Perhaps we'll see applications customized for industry type, or even better, customized by functions within that industry. Or customized for particular departments within a specific company. Or even better, for a particular user.

Still, who will actually assemble and customize all these programs?

The traditional retail and direct channels are great at distributing big applications, but in this model, software is effectively customized for everyone and no one. Power users can make a few minor tweaks to an existing application, but that's not what we really want.

Perhaps hardware vendors who customize today's PCs will customize tomorrow's software. But can they really be expected to understand both hundreds of packages and the way that each individual works? Maybe we'll see a new breed of value-added resellers who specialize in setting up software systems for others. Perhaps we'll see more in-house system integrators who will create packages appropriate for individual workgroups. But will they be able to deliver what we want in a timely fashion?

The best solution would be software so intelligent that it can customize itself. Perhaps it will ask you questions about how you work. Perhaps it will sit in the background, watching what you do and anticipating your next requests. Perhaps it will look at the other programs on your system and modify its behavior accordingly.

I wonder whether someday customizing and distributing software will be as much of an issue as creating the individual building blocks. ■

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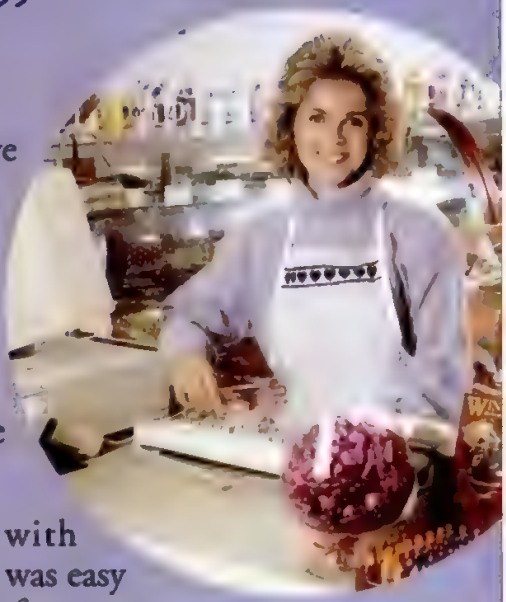

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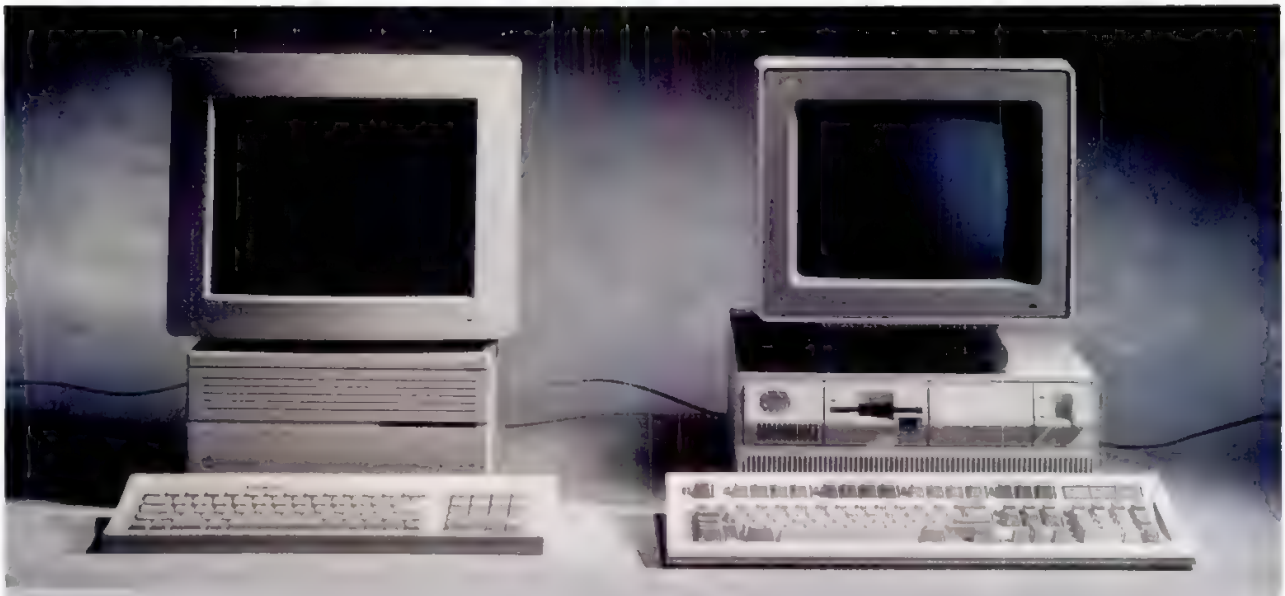

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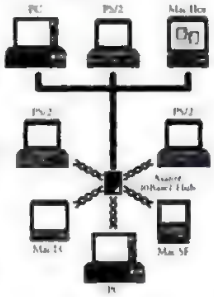

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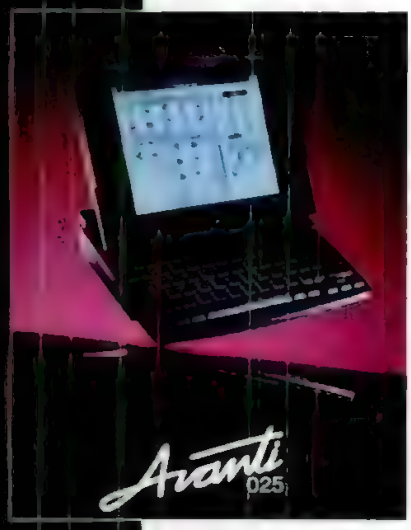

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Bill Machrone

IBM Takes It from The Top

OS/2 2.0 is getting its marching orders from the highest levels within IBM, even at the cost of direct competition with Microsoft.

Recently, I spent a morning talking with Jack Kuehler, IBM's president. Our videotaped interview was to be shown to potential customers who wanted to hear about IBM's commitment to OS/2 from the highest levels and who wanted the questions posed by an outsider with no vested interest in IBM. I was pleasantly surprised by Kuehler's familiarity with the issues, and how committed he is to making OS/2 2.0 a winner. Here's a condensed version of our conversation, with additional comments.

Machrone: Does IBM have a vision for OS/2 and how it fits into the big picture?

Kuehler: Microprocessors are becoming more and more powerful, which allows people to have much higher-level interfaces. More human, more natural interfaces require this power, which will generate a broader set of users. Multimedia demands power: voice, video, text, graphics, speech, and music. These add to the power of the interface and make it attractive, particularly with the computer-literate kids coming out of our schools.

Meanwhile, communications is sneaking up on us—growing at an amazing rate in both performance and function. Visualize the personal computer of the future in terms of the processor, memory, and outboard storage. Communications provides virtually infinite bandwidth via fiber optics or satellite, at a very low cost. You can make a major trade-off in terms of how much local storage you have and you can redefine your applications and the size of your product as a result. Software is the key enabler, not just the operating system, but the tools that will make both the development process and the applications more exciting.

Comment: *It's great to see IBM looking at the big picture, but that vision of little machines hooked up to huge, remote storage and communicating at light speed sounds like the apotheosis of Prodigy or a rehash of the mainframe era.*

Machrone: But why do you need a new operating system to do all that?

Kuehler: You need to be able to exploit the power of the processor, and that means 32 bits, multitasking, and managing multiple streams of data. Object-oriented technology is also important, not only for the interface, but also for the ability to customize and add new functions as they come along. OS/2 2.0 is brand-new code. It has a major performance benefit. We can say very clearly that performance is equal or better than under Windows 3.0. The new 32-bit applications will run 40 to 45 percent faster than their 16-bit equivalents.

Comment: *Multiple threads of execution and the robustness of applications protected from one another are the hot ticket, especially if they're backward-compatible with DOS and Windows applications.*

MICROSOFT: FRIEND OR FOE?

Machrone: How does OS/2 2.0 fit with NT? Aren't IBM and Microsoft cross-licensed on NT, OS/2 2.0, and OS/2 3.0?

Kuehler: We could spend the next hour talking about this. Let me just say simply that NT, as I understand it, is a part of what we had envisioned 3.0 to be. But there's a part missing, at least at this point in time. NT does not intend to support OS/2 2.0 or our next PM release. We have rights to NT, but I believe that OS/2 2.0 provides virtually all the functions now that NT will provide in the future.

ILLUSTRATION: DAVID TURNER

Machrone: With OS/2 striving so hard for the desktop, has anything been sacrificed in the connectivity arena?

Kuehler: We've made a number of extensions to the Communications Manager, and we'll continue to advance in this area. We can handle personal computer-to-host as well as client-server systems. We'll support *NetWare* under OS/2 and we're working on simultaneous

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coexistence with our LAN Server. We're working with Banyan on a *VINES* implementation, too.

Machrone: In the middle of all this focus on client-server networking, we've seen a huge upswing in interest in peer-to-peer networking and the more casual connectivity that we see in the Macintosh market. Is there any hope for peer-to-peer connectivity under OS/2?

Kuehler: Apple has done a nice job there. In our market we have de facto hardware standards in Ethernet and Token-Ring that have no parallel on the software side. There are many products, and we're going to package some of this technology with the OS/2 system. There are some holes in what's out there today. You'll see us plug those, then you'll see more progress next year. This isn't rocket science, it's just a matter of getting on with it.

Machrone: Frankly, we're surprised at the positive feedback we've gotten from the developer community on OS/2 2.0's development tools. After all, IBM doesn't have a track record in this area. How do you explain this?

Kuehler: Nearly all these tools were developed internally by our teams in Boca, Yorktown, Lexington, and Toronto. IBM has a long history in languages and compilers. These tools are an extension of technology that has existed within my company. The toolkit is now 32-bit. We're also working with Micrografx on their Mirrors technology, and Borland is bringing a set of development tools that will be helpful. But by and large, these tools come from the skills and competencies of the IBM company.

Comment: *Micrografx and Borland think they've had a bit more to do with it, but what the heck.*

RETAIL SALES: SHEDDING THE NAVY SUIT AND WHITE SHIRT

Machrone: Can IBM learn retail before Microsoft learns to service big companies?

Kuehler: We know the dealers well already, as well as our large customers. But we're planning a very aggressive strategy to expand our reach to the end user through distribution, mass marketing, corporate resellers, along with promotion and advertising. We're going to do all these things.

Comment: *They'll have to.* ■

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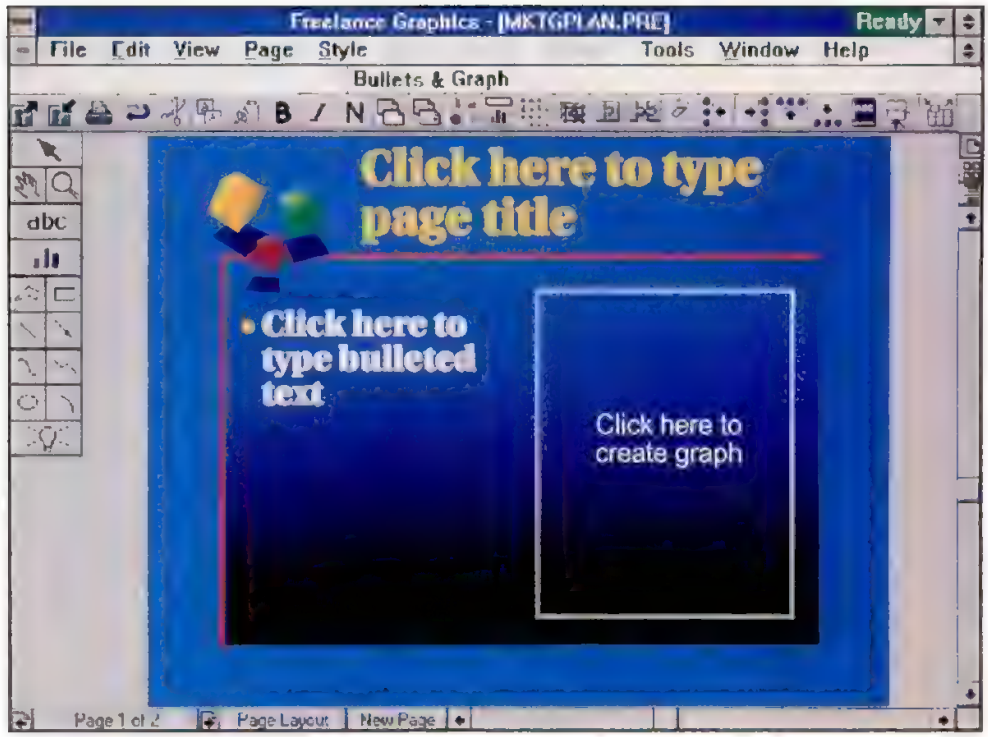

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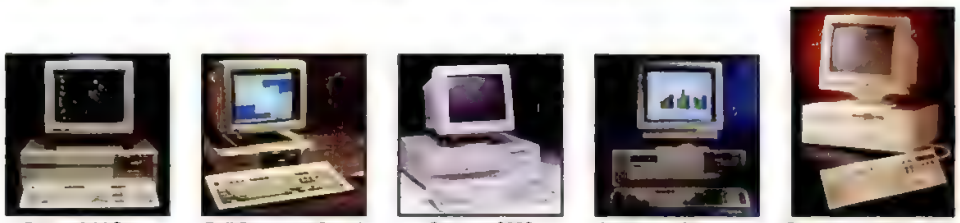

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How long does it take to get a support representative on the phone? (most frequent answer)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Technical competence of support representative (10 is best)	7.5	8.1	8	7.8	8.1
How long does it take for the vendor to solve your problem? (most frequent response)	[illegible]	1 to 2 days	2 days or longer	[illegible]	[illegible]
If your job depended on it, would you recommend buying more PCs from this firm?					
Overall rating for service and support (10 is best)	6.9	7.9	7.5	7.8	8.3

NOTES: Customer satisfaction results were compiled from PC Week's survey of PC managers whose organizations have purchased mail-order PCs. 15 customers of each vendor were surveyed.

Prices and specifications shown were supplied by vendors, each of which was asked for a quote on its lowest-priced 25Mhz 386 machine with 4M bytes of RAM, dual floppies, a 100M-byte hard drive, 14-inch Super VGA monitor, keyboard, mouse, Windows and DOS 5.0. Any changes to the configuration or no-cost options are shown. Prices were gathered by calls to each vendor between Oct. 3 and Oct 14, and include tax and shipping charges.

*System is upgradable.

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John C. Dvorak

Will IBM Dump the Mainframe?

Is anarchy at work at IBM, or does the company that made the mainframe have some radical plans for the future?

The notion begins with screwball reports, followed by gossip about how IBM is laying off the wrong people or how there are morale problems at IBM. Just last week a fax crossed my desk from the *Orange County Register*. Then an article in the business section of that same newspaper discussed the "True Blue Newsletter"—a subversive internal pamphlet complaining about current IBM personnel policies. Rumor has it that people at IBM are demoralized, grumpy, fed up.

If all this isn't bad enough, a song insulting to John Akers—sung to the tune of "Big Bad John"—is circulating around IBM. Almost everyone there knows it.

It's one thing after another, and the press and public perceive the mess. Will Zachmann recently predicted that if OS/2 isn't a huge success, then IBM will go broke. Soon.

Are we all missing the point here? Is it possible that there's some grand scheme afoot at IBM that will reshape the company for the decades ahead? Are we seeing part of the plan?

Since the invention of the microprocessor, many observers of technological trends have believed that mainframes and big systems were doomed by cheap desktop computers. As we approach 100-mips microprocessors sold as part of a $2,500 computer, only a few large corporations will continue to need large mainframe business computers—for oil exploration, weather analysis, and such. Besides, most of the computing in those corporations will be done at the desktop or server level anyway. PCs will turn the mainframe (and most minicomputers) into niche machines.

A niche machine won't propel IBM into the next century. IBM's top minds know this and have been secretly planning a massive transition. Not wanting to panic its shareholders or employees (who will be looking for work elsewhere), IBM decided to try and do this calmly, instead of yelling "Fire!"

Remember, Big Blue has dumped many of its businesses before. It used to make synchronized clocks, typesetters, and even meat-market scales. Well, IBM doesn't hang on to anything longer than its useful profit-making life.

We can expect IBM to someday quit the mainframe business just as it quit these other businesses. After all, no federal law says IBM has to build mainframes forever. The big question is: When will IBM drop the bombshell and let us know? The way microcomputer technology is progressing, the time is near.

CORPORATE REINCARNATION

What will IBM do in its next iteration? We have to read between the lines and scrutinize IBM's current ventures and the state of business today. What have we heard about recently from IBM? Research, that's what. IBM is doing chips, all sorts of chips. IBM has even invented a new memory chip and leads the Japanese in memory research. It is stockpiling an enormous number of patents—more than any other American company.

Coinciding with this buildup is the increasingly litigious nature of high technology. Hardly a week goes by without some new hi-tech lawsuit. Texas Instruments makes most of its profits from licensing nowadays. Suits dominate the news. Roger Billings has sued Novell for $672 million over networking concepts (patent No. 4,714,989). The Token-Ring inventor is following a similar course of action. In every area of computing, suits are pending.

ILLUSTRATION: DAVID TURNER

Maybe IBM knows this is the future. Maybe it figures that now is the best time to just get out of the business and collect easy money doing nothing but fun-filled research for the purpose of getting to the ideas before someone else does. The game is easy: patents, suits, licensing, suits, profits, more suits. ■

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CIRCLE 282 ON READER SERVICE CARD

John C.
Dvorak

Inside Track

It's About Time Dept.: I recently saw the little **Cyrix 486 chip.** Pin-compatible with the 386SX, this has to be one of the best ideas around. Unlike the Intel 486SX, which is a 486DX chip that has been crippled, this is a real 486SX. With this chip, Cyrix allows manufacturers of 386 machines to make 486 machines with no redesign. **It pops right into the 386 socket.** It will sell like hotcakes. Intel should have developed it.

Lawsuit Humor: All these lawsuits are funny enough without lawyers making ludicrous comments. AT&T apparently was sued for **patent infringement,** and the company said, "Yesterday's decision in Texas notwithstanding, we believe this suit is totally without merit because the patent is invalid and because the 5ESS switch doesn't infringe the patent, even if it were valid."

Does anyone else find this statement **sounding a little like Bart Simpson?** Gimme a break! "I didn't do anything. And nobody saw me, so you can't prove a thing!"

Peeves-Are-Us Dept.: Here's a little contest I want to run. Send me your **basic complaints** about software and I'll create a master list of peeves. Here are some examples: programs that won't install from the B:\ drive; programs that modify your CONFIG and AUTOEXEC files without telling you; programs that have you load disk after disk after disk, only to then tell you that you haven't got enough room on your hard disk to complete the installation. Send your favorites to Peeves, c/o John C. Dvorak, *PC Magazine,* One Park Avenue, New York, NY 10016.

Microsoft Report: What's really behind the Microsoft buyout of Fox Software? In the opinion of many insiders, it was just done to **keep Borland honest.** Microsoft wouldn't have purchased *FoxPro* (which is written in Watcom C, not Microsoft C, incidentally) if Borland hadn't bought Ashton-Tate. The way Microsoft saw it, Borland was just going to use *dBASE IV* as **a cash cow.** Now Borland has to support and advance the product, lest Microsoft take the lead. Microsoft sees this as a way to **stress Borland,** forcing it to allocate resources to both *Paradox* and *dBASE.*

One **funny aspect** to the deal is that Microsoft's payment of $170 million was in stark contrast to a deal that was nearly made over a year ago to merge Ashton-Tate and Fox. The merger would have meant Fox would have been "sold" for $30 million. It would have resulted in a healthy Ashton-Tate and none of this **macho posturing** by Microsoft and Borland. Unfortunately for Ashton-Tate (and Borland), some **bumbler** on the Ashton-Tate board **queered the deal.**

This Microsoft buyout should have been **no surprise.** *PCUser,* a British magazine, reported on November 20, 1991, "Fox negotiated with Microsoft over a possible purchase about 18 months ago, according to a source within Fox. But the lawsuits with Ashton-Tate proved to be a stumbling block. Although the talks have not been reopened since last month's dropping of the copyright case, Fox would be keen to make a deal, the source said."

> What's behind the Microsoft buyout of Fox Software? Microsoft sees this as a way to stress Borland, forcing it to allocate limited resources to both *Paradox* and *dBASE.*

An interesting and forgotten aside to all this is that Ashton-Tate management was originally **dominated by Scientologists.** I assume the leftovers are at Borland now.

Mo' Money, Mo' Money, Mo' Money Dept.: Microsoft is serious about selling data and presentations. Besides buying electronic rights to fine art, **Microsoft is buying** bits and pieces of strategically placed companies. A perfect example is its purchase of 26 percent of British book publisher Dorling Kindersley. The London-based bookseller publishes illustrated reference books, including such best-sellers as *Your Baby and Child* by Penelope Leach and *The Way Things Work* by David Macauley. *The Way Things Work* is a wonderful book that would be a great multimedia title. I can't wait!

In a **canned explanation** for this new direction, Gates made the comment, "To date, most software has provided tools for customers to use, such as spreadsheets, word processors, and databases. With multimedia titles, however, the shift is toward providing content to customers. And Dorling Kindersley's books represent a wealth of information that can become multimedia titles." Yeah, 600 titles to be exact!

PostScript Postscript Dept.: With Microsoft's adoption of its own TrueType fonts for Windows 3.1, PostScript for the PC will be fighting an uphill battle. **Why buy a cow when milk is free?** To further sweeten the pot and lure people away from PostScript, Microsoft is doing deals with font foundries such as Monotype. Right off the bat Microsoft offered a **44-type font pack for $99.** With such low prices and TrueType preinstalled inside Win 3.1, we can expect Adobe to be outflanked despite its **superior PostScript technology.** It looks like we'll have a two-standards typeface scene with **Microsoft making the most** money. ■

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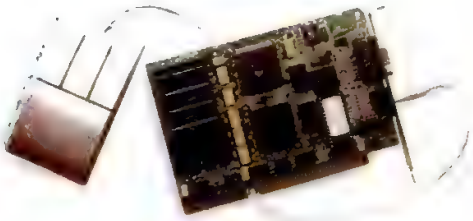

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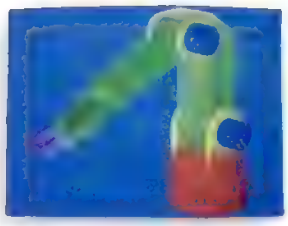

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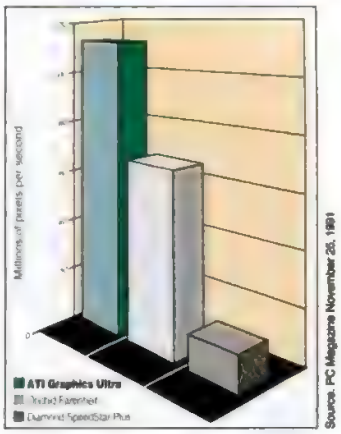

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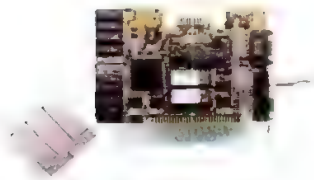

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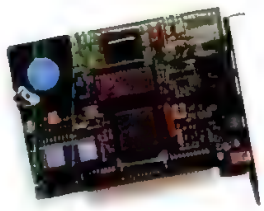

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CIRCLE 163 ON READER SERVICE CARD

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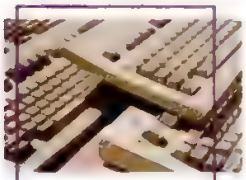
Available in single- and dual- port models, Modem Sharing Kits quickly and easily allow dialing out to remote computers, and dialing in from anywhere off your LAN.



In just five minutes, you can "plug" your kit into your LAN, and everyone has a modem!

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The V.32 *bis*/V.42 *bis* modem with ASL is extremely fast,allowing throughput up to 57,600 bps

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If you have ever tried to configure modems on a LAN, you'll appreciate how easy the Shared Access Modem Sharing Kits are to install. In five minutes, your modem is ready for anyone on your LAN to use. Its simple user interface requires no special training or user support services. Just point, click and connect.

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Just point, click and connect

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CIRCLE 231 ON READER SERVICE CARD

Jim Seymour

New Channels, New Respect

Knowledgeable salespeople, effective display marketing, and good prices: Is this really a retail computer store?

Over the years I've spent a lot of time walking around in PC outlets, kicking tires, noticing how hardware and software are displayed and sold, and eavesdropping on conversations between customers and salespeople. It's always enlightening, if very often dismaying.

I'll skip all the bad jokes about the smarts and ethics of salespeople in computer stores. I've found too many of them who aren't very knowledgeable, but only a few were consciously misrepresenting what they were selling. I chalk that up to bad management, because it represents a lack of sales training, not any personal failings of these people. Many were sales gypsies who had been selling video equipment six months before and will be selling stereo gear six months from now, so the lack of product knowledge is understandable, if not forgivable.

It's also interesting on these visits to notice how badly most retail computer outlets handle merchandising: how the goods are displayed and promoted on the floor. Even simple things, such as freestanding kiosks for hot products or "hang tags" to highlight a product's features, are rare. Just finding the manufacturer's point-of-sale literature can be tough; I've seen plenty of out-of-date, earlier-version sales brochures displayed with computer products.

Given the PC business's low standards in both areas, decent-quality salespeople and merchandising are all the more dazzling. In the land of the blind, the one-eyed man is king. . . .

Those standards are changing, though, and not only in the ways you'd expect. Nearly everyone who uses a PC must have heard by now about the superstores phenomenon. These discounters, led by CompUSA (formerly Soft-Warehouse), pack a huge jumble of goods into barnlike stores. Customers wander the aisles, often with a glazed look, pushing grocery carts full of software, modems, cables, and disk-storage gizmos.

As enthusiastic as I am about superstores, they're not a complete answer to PC buyers' needs. Corporate buyers do well enough with the national-accounts divisions of major hardware and software vendors and their local network VARs. Local outlets of the national chains are there to serve far-flung branch offices. And savvy individual PC buyers thrive on a mix of direct marketers and superstores.

But what about that huge group of PC buyers in the middle? As a class, they're far more knowledgeable than they were just a few years ago; but small businesses, newcomers, the home-office crowd, and other constituencies that still need advice want low prices and deep inventory just as much as the next guy.

So lately on my travels I've been spending a lot of time in the office-supplies superstores, electronics discounters, and other national chains that constitute the newest but least-recognized force in the PC business. I went in their doors with low expectations, and, probably, an uppity attitude.

PRACTICING GOOD BIZNESS

What I found, though, has in some cases startled me: well-trained salespeople, great merchandising, a good range of name-brand hardware in stock at very aggressive prices, and the best software selections I've seen outside of Egghead stores.

ILLUSTRATION: DAVID TURNER

The two best chains, by far, have been BizMart and Circuit City. (I hesitate to tag any chain as the worst, but I've consistently been disappointed in BestBuy stores.) BizMart's larger stores, especially, are appealing places to buy computers. They sell name-brand CPUs—Apple, Hewlett-Packard, IBM, NEC, and a few more—and are full of great buys on things like HP LaserJet printers.

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CIRCLE 069 ON READER SERVICE CARD

Jim Seymour

The displays, merchandising, and level of sales training may be even more impressive than the inventory. Most of the time, even my more obscure questions have drawn correct answers, and I've often heard one of my favorite answers: "I don't know, but I'll find out." More important, as I've eavesdropped on dozens of conversations between BizMart salespeople and relatively naive customers, I've heard good advice. Buyers were being steered toward the kinds of systems I'd have recommended, not toward what the store needed to move at the moment or a loser of a discontinued product.

The Circuit City stores I've seen were less consistent, but still good. The inventory is thinner, with fewer top-of-the-heap name brands. But once again, I heard little of the kind of sales blather that used to be so common with computer retailers.

This more professional approach to computer retailing is paying off big for Intelligent Electronics, operators of the BizMart stores. In the last quarter, BizMart sales rose 148 percent, to $175 million, and profits, though still low as a percentage of sales, increased almost tenfold to $1 million. BizMart could hit $1 billion in sales next year.

Store-to-store consistency is one of the hardest goals to achieve in operations on this scale, and I don't pretend that BizMart or any of the other office-supplies and consumer-electronics discounters are able to achieve this kind of environment in all of their stores. But in my sampling of a dozen of BizMart's 75 stores, I also didn't find any bad ones.

Many of us have tended to dismiss consumer-electronics showrooms and office-supplies dealers as ill-equipped to sell PCs and supporting equipment. Certainly, there was a time when most of them carried only the most marginal brands—crummy stuff few readers of *PC Magazine* would want to take home.

But times have changed. If, like me, you've been inclined to ignore these outlets in favor of "real" computer stores or direct marketers, maybe it's time to kick some tires down at the local BizMart or Circuit City.

I did, and the other night I walked out with an HP LaserJet IIP PLUS, sold to me by a guy who knew what he was talking about, and for a few bucks less than the best mail-order price I could find. ■

New $99 Peachtree Basic. Easy-To-Use PC Accounting From The People Who Invented It In The First Place.

At Peachtree, we've been doing accounting on personal computers longer than anyone. In fact, we created the very first accounting program for the IBM PC, the award-winning Peachtree Complete.

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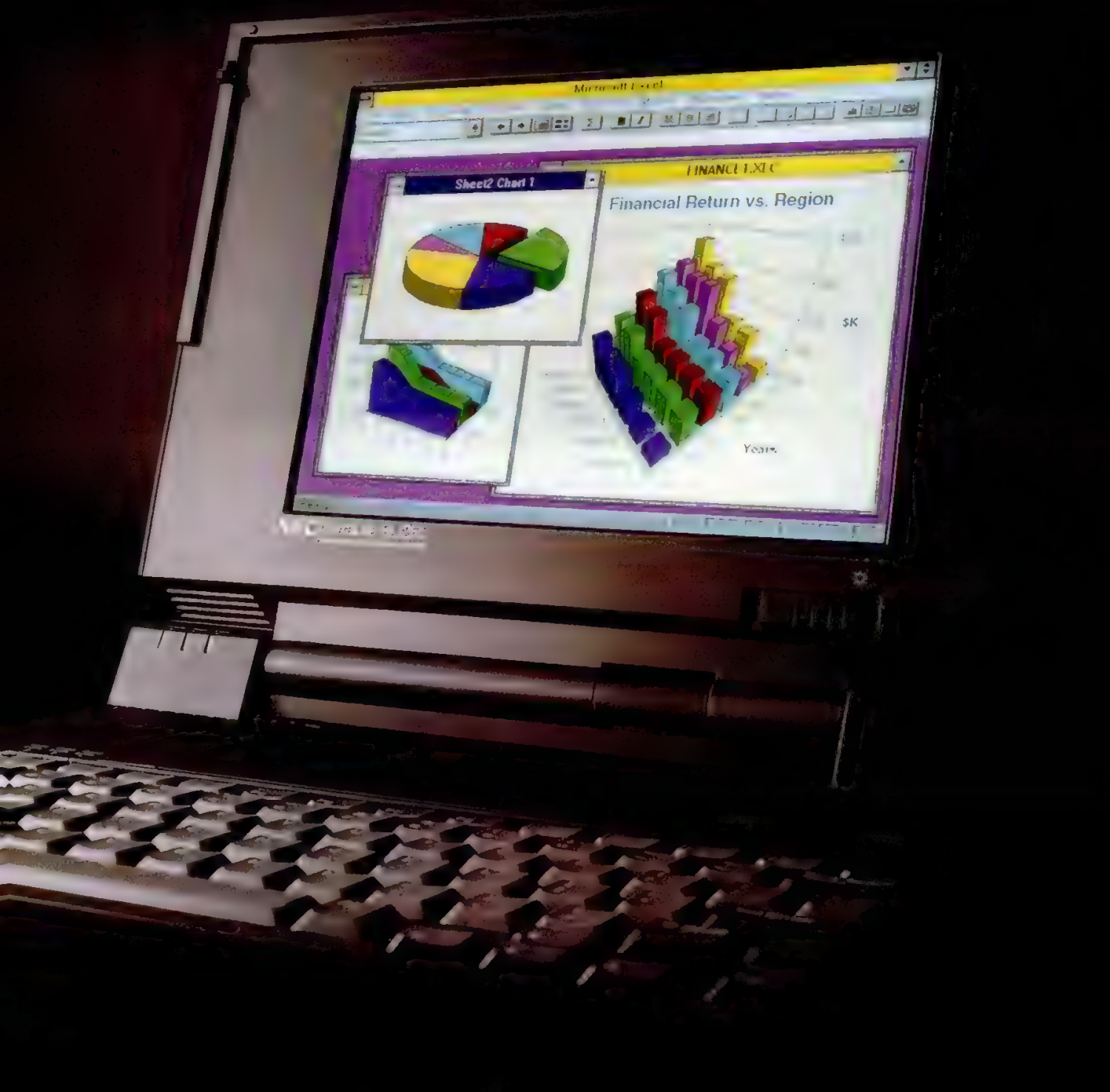
CIRCLE 358 ON READER SERVICE CARD

Introducing the be
notebook co



st color display in a mputer. Ever.

In its review of our UltraLite® SL/25C notebook, *PC Magazine* said, "NEC is about to make the future of portable computing a whole lot brighter."

We couldn't agree more.

The best color display in a notebook. Ever.

The fact is, NEC is the first to offer an active-matrix TFT color screen in a notebook, and yet, in the words of *PC Magazine*, "its price tag rivals lower-quality passive-matrix offerings."

What's the difference between active-matrix and passive-matrix color screens? One looks vivid, sharp and bright, like your desktop monitor. The other doesn't. One can be viewed from wide angles. The other can't. One is clearly the future of notebook computing. The other isn't.

The best processing technology in a notebook. Ever.

To quote *PC Magazine* once more, our SL/25C "has more going for it than just spectacular color. It's also one of the first notebooks to use Intel's new 25-MHz 386SL chip set."

The new chip provides all the processing punch of a 386 desktop PC. Offers intelligent power management for longer battery life. And runs even the most complex applications at blazing speed. The 7.5 lb. SL/25C comes standard with 2MB of RAM (expandable to 10MB), an 80MB hard disk, internal floppy and 64KB cache. As well as MS-DOS® 5.0 and Windows,™ loaded and ready to run.

It does everything a powerful desktop does. Except chain you to a desk.

There's a serial port, SuperVGA CRT port, PS/2® mouse port and optional internal modem. An enhanced parallel port allowing improved throughput for network connections. And an optional full-function, portable Docking Station™ unit—with two expansion slots and a 3.5" drive bay—that not only turns the SL/25C into a desktop you can take anywhere, it also gives you other options, like fully integrating sound and image to create your very own portable multimedia platform.

A powerful argument for color, right here in black and white.

It also has a brilliant VGA display. A palette of over 225,000 colors. A fast screen refresh rate (so you never lose your cursor). And a "simultaneous video" feature—so the image you see on your screen can also be viewed on an external video device, like a big-screen projector.

Shown with optional Docking Station.

What's more, the SL/25C comes with an industry-leading 2-year limited warranty.

Call today.

For more details, call 1-800-NEC-INFO. Or call NEC FastFacts™ at 1-800-366-0476, #ULSL25C (8575252). In Canada, call 1-800-343-4418.

We'll give you enough information about the SL/25C to make you not want to be without it. Ever.

C&C
Computers and Communications

Because ↑ is the way you want to go. **NEC**

CIRCLE 157 ON READER SERVICE CARD

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Adobe Streamline Windows	120
Adobe Type Manager Windows	59
After Dark	27
Ami Pro 2.0	275
Becker Tools	70
Borland C++	289
Carbon Copy for Windows	111
Corel Draw 2.0	359
Crosstalk for Windows	115
dBFast	325
Designer	446
Drafix Cadd Windows	410
Facelift for Windows	59
Facelift for Windows ValuePak	117
Formbase for Windows	295
Grammatik for Windows	55
Harvard Graphics for Windows	339
hDC File Apps	70
hDC FirstApps for Windows	53
hDC ICON Designer	32
hDC Windows Express	53
IBM Current	213
Lotus 1-2-3 for Windows	395
Mathtype Windows	155
MS Entertainment I,II,III	25
MS Excel for Windows	293
MS Money for Windows	$42
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MS PowerPoint for Windows	293
MS Productivity Pack	36
MS Project for Windows	412
MS Publisher for Windows	118
MS Word for Windows	293
MS Works for Windows	118
Norton Desktop	93
Objectvision	94
Omni Page 386	436
On Time for Windows	70
PC Kwik Power Pak	69
Packrat v4.0 for Windows	235
PageMaker 4.0	499
PerFORM Pro	178
PFS Professional Write Plus	158
RightWriter for Windows	53
Superbase 4	451
Toolbook	280
Turbo C++ Windows	93
Ventura Publisher Gold/Windows	499
WinConnect	59
WINFAX Pro	70
Winspeed	☎ 93
Wintools	119
WordPerfect for Windows	256
Wordscan + 286/386	647

OFFICE ON THE GO

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Appoint	
Thumbeline Portable	$59
Battery Watch Pro	29
Brooklyn Bridge w/Par & Ser Cable	85
Laplink Pro	☎ 99
Leading Edge LT386+	1439
Logitech Mouseman Serial Cordless	82
Microsoft BallPoint Mouse	110
MicroSpeed MicroTrac	54
VGA Dimmer	23
Winconnect	59
Toshiba	
T2000SX	1798
T2200SX	2398
T5200	3227
Others	Call

NOTEBOOK

AST	
Exec 386SX-20 40MB	☎ $1905
Everex	
Tempo LX 386SX -20 1/20 Mb	1915
NoteStar	
386SX-20 2/40 MG,1.44 VGA	1689
386SX-20 2/80 MG	1623
Panasonic	
All Models	Call
Texas Instruments	
3000 20MB	929
3000 40MB	1822
3000 WINSX 386	2481
Other Models	Call

PALMTOP

Poqet Hand Held	☎ $546

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HARDWARE

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CD ROM INT CDR-36 XT/AT w/int	$444
CD ROM EXT CDR-73 M w/Int	☎ 630
CD ROM INT CDR-83 M w/Int	567
COREL Blockbuster Bundle Int	915
Panasonic Worm 940 MB	2340
Sony	
CD ROM INT	410
CD ROM EXT	440

SOUND CARDS

Creative Labs	
Sound Blaster	$107
Sound Blaster Pro	☎ 188
Ad Lib Music Synthesizer Card	72

SOFTWARE

Atlas Pak	$63
Mammals	87
NEC Type Gallery PS	235

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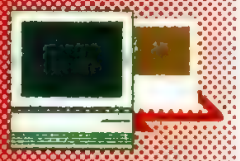
Nat Geographic	44	98
PC SIG Library	29	NA
Stellar 7	33	39
Wing Commander	45	69
Zip Plus +	45	123
14 Other Titles	Call	Call

NETWORKING & LAN



SOFTWARE

ACCPAC BPI LAN	$230
Dac Easy Network Acct	180
Data Ease Access Server 3-Pak	511
Direct Access Network Unlimited	355
FoxPro Dist Kit	285
FoxPro Lan 2.0 - 6 Pak	515
Lotus 123 3.1+ Network	☎ 618
MS Excel License Pack	234
Netroom Single (dual)	58
Norton PC Anywhere LAN	316
Novell NetWare Lite	65
Novell NetWare 386 10 Pk	1387
Peachtree Network	495
Print Q LAN (4 User)	269
Procom + LAN - 5 Pak	319
Q & A Network Pack	320
Quattro Pro Lan	255

HARDWARE

Eagle	
NE2 Netw LT Combo Add on (3.5)	$259
Netw are LT Combo Add on (3.5)	204
Netw are LT Combo Add on (5.25)	204
Netwr LT Cmbo NE/2000 Strt (3.5)	400
Netwr LT Cmbo NE/2000 Strt (5.25)	400
Artisoft	
Lantastic 2MBPS Starter	331
Lantastic Ethernet Starter	☎ 455
Others	Call
Standard Microsystems	
Ethercard Plus 8 bit Elite	118
All Other Models	Call
Tiara	
All Other Models	Call

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Auto Sketch 3.0	$140
Design CAD 3-D	☎ 166
Generic CAD 6.0	281
Generic CAD Starter Kit Level II	85
Math CAD	298
Summasketch 12x12 II 4 or 16 Butn	315
Summasketch 12x18 Pro II 4 or 16 Button	539
Turbo Cadd	75
CalComp	
33120-34 Drg12x12 16B	289
33120-34 Drg12x12 4B	289

EVEREX TEMPO CARRIER NOTEBOOK

The Tempo Carrier gives you full 20MHz i386SX power yet weighs in at under five and a half pounds. The Carrier comes with a 40MB or larger internal hard drive, 1.44MB Floppy and up to 8MB of RAM.

$2229

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HARDWARE

Complete	
Full Page GS/w Wordscan	$625
Half Page 400 DPI	105
DFI	
Scanner HS-3000+	141
Logitech	
Logi Scanman 256 for PS/2	289
Logi Scanman 256	☎ 258

SOFTWARE

Catch Word for OCR	$132
CAT Reader Pro 1/2 Page	156
Omnipage 386 Windows	436
OmniProfessional 2.0	629

TERMINALS

Wyse	
30+	$270
60	☎ 286
150	263
160	326
185	342

386MAX V6.0 FROM QUALITAS

Winner of the 1991 BYTE Award of Merit, PC Magazine's Editors Choice award, and InfoWorld's Top Scoring Memory Manager, 386MAX 6.0 enhances Windows and supercharges DOS 5.0.

$52

HARD CARDS

Plus Development	
II XL50 MB	$287
II XL105 MB	☎ 423
Other Models	Call

DISKETTES

Sony	
3.5 D/S D/D (100)	$70
3.5 H/D (100)	115
5.25 D/S D/D Disks (100)	50
5.25 High Density (100)	82

CO-PROCESSORS

Cyrix	
80387-DX 25	$141
80387 DX 33	152
80387 SX-16	☎ 87
Intel	
80387-DX 33	200
80387 SX-16	119
80387-SX 20	130
Others	Call

PCM61892

KEYBOARDS

Keytronics **KB101Plus**	☎ $32

TAPE BACKUP

Colorado Memory System	
Jumbo 120/250 INT	$246
Jumbo 60/120 INT	☎ 189

POINTING DEVICES

Logitech Mouseman Serial /PS2	☎ 85
Logitech Trackman Portable	93
MS Ballpoint Mouse	110
MS Bus or Serial (Windows	142
Microspeed PC Trac Ser or PS/2	70

SOUND BLASTER PRO FROM BROWN-WAGH

From business presentations, to music, education and entertainment, Sound Blaster Pro puts stereo sound on your desktop at an affordable price.

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BOARDS

ATI	
VGA Wonder XL 256K	$148
VGA Wonder XL 512K	☎ 198
Diamond	
Speed Star Hi-Color	174
Speed Star Plus VGA	163
Stealth 1Mb w/Hi-Color	259
Everex	
RAM 3000 Deluxe	73
RAM 8000	167
Hercules All Models	Call
Intel	
Above Board + 512K Plus	268
Above Board + w/2MG P/S	394
Above Board + w/2MG Expands to 8 MG	364
Inboard 386 PC (1MG)	489
Other Models	Call
Orchid	
Tiny Turbo 286	114
Tiny Turbo Xtra	171
Other Models	Call
Paradise	
VGA + 256K	103
VGA 1024 512K	187
Video 7	
1024 I w/256K	120
Other Models	Call

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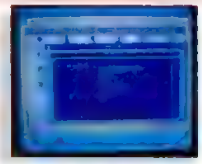
14" CM 8484 EX	308
Amdek All Models	Call
Arche	
14" VGA Paper White	113
14" SVGA .28 1024 X 768 Non-Intlcd	339
Mitsubishi	
XC 1418 C EGA	☎ 228
XC 1429 C VGA	376
Other Models	Call
NEC	
Multisync 2A	384
Multisync 3FGX 14"	658
Multisync 4FG 15"	782
Multisync 5D 21"	1573
Multisync 5FG 17"	1400
Multisync 6FG 20"	2799
Princeton Ultra 1600	[illegible]
Sony Multiscan 1304S 14"	592
Zenith ZCM 1492	[illegible]

FONT CARTRIDGES

Pacific Data 1-2-4 Plus 2 MG	$235
Pacific Data 1-2-4 Plus 4 MG	354
Pacific Data 25 IN 1/III	259
Pacific Data 4 Memory 1MB	97
Pacific Data 4 Memory 2 MB	☎ 139
Pacific Data 4 Memory 4MB	235



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486-33 EISA,4MB, 340/660 M, Win 3.0 & Logi Mouse, Non-Intrlcd SVGA	3595
486-33/128C,4MB, 210/425 M, Win 3.0 & Logi Mouse, Non-Intrlcd SVGA	2375
8-User	118

EDUCATION & TRAINING

AutoMap	$47
Bodyworks	39
Math Blaster Mystery	28
MS Learning PC DOS	30
Orbits	29
PC Globe, PC USA	Call

PRINTERS

LASER

Epson	
Action Laser II	$713
Hewlett Packard	
Desk Jet 500C	745
Laser Jet IIP +	848
Laser Jet III	1585
Laser Jet III P	☎ 1082
IBM LaserPrinter 5ppm	1089
NEC Silentwriter II Model 95	1441
Okidata	
OL-400 Par	618
OL-810	Call
OL-830	1304
OL-840	1606
Texas Instruments	
Micro Laser	834

DOT MATRIX

Citizen Printer	
200GX-15	$297
GSX 140 +	296
Other Models	Call
Epson	
LQ570	271
LX810	162
Other Models	Call
NEC All Models	Call
Okidata	
184T IBM	222
321 ML Par	433
PaceMark 3410	1261
Other Models	Call
Panasonic	
1123	☎ 205
1124i	292
1695	375
New 2000 Series	Call
2624	387
Other Models	Call
Star Micronics	
NX 1001	140
NX 1020 Rainbow	184
Other Models	Call

OTHER

Canon BJ-10EX	$325
Seiko Smart Label + Printer	128

COMMUNICATION HARDWARE

ATI	
2400 ETC INT w/SW	$105
2400 ETC EXT	129
Cardinal All Models	Call
Complete	
Communicator	289
Other Models	Call
Everex	
Evercom 12 INT	46
Everfax24/96 INT	246
Other Models	Call
Hayes	
2400 B	218
Other Models	Call
Intel	
2400 B Classic	135
2400 EXT	167
Satisfaction Classic	337
Practical Peripheral	
All Models	Call
Prometheus	
2400 B w/Software	54
Pro Modem 9600 + EXT	672
Other Models	Call
U.S. Robotics	
All Models	Call
Zoom	
2400 EXT V.42 Bis	☎ 113
2400 EXT w/4800 fax	65
2400 EXT w/9600 fax	73
2400 INT w/9600 Send/Rec	103
Other Models	Call

DISK DRIVES

Conner	
All Models	Call
Iomega (Bernoulli)	
Beta 44 MGTransportable	850
Beta 44 MG Insider	755
Other Models	Call
Maxtor	
7080A 80MG IDE	275
LXT 213A 200MG IDE	608
Micropolis	
All Models	Call
Seagate	
ST3144A 130 MG	380
ST3096 A MG	294
Other Models	Call
Teac	
3.5" 1.44 MG AT	☎ 58
5.25" 1.2 MG AT	60
Toshiba 3.5 1.4 MG	56

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Formtool Gold 3.0	☎ $53
PerFORM 2.1	88

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Lotus 1-2-3 Ver. 2.3	☎ [illegible]
Lotus 1-2-3 Ver 3.1 +	390
Plan Perfect 5.1	225

ELECTRONIC MAIL

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Platform Pak (DOS)	121
8-User	118
25-User Expandable	372
Gateway	817
Remote	190
WordPerfect Office v3.1	82

OPERATING ENVIRONMENTS

Dr DOS v6.0	[illegible]
MS DOS 5.0 Upgrade	45
MS DOS 5.0 OEM	49
MS DOS 5.0 (MS Full)	59
MS Windows Ver. 3.1	☎ 89

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Professional Developer	444
Clipper	498
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FoxPro Dist Kit	285
FoxPro Single User 2.0	449
Infoselect	87
Paradox 3.5	469
Q&A	☎ 259
R & R Relational Report Writer	163

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Over the last several years, I have had occasion to buy from you. I have always found your prices very competitive and your sales people helpful and courteous.

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Robert Ausenhus
Loveland, Colorado
January 25, 1991

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Tobias Managing Your Money v.8.0	94
Wealth Builder	90

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Back It 4	$72
Central Point Backup	81
Fastback Plus 3.0	☎ 115
Norton Backup	82

GENERAL

Copy II Option Board Deluxe	$119
Copy II PC 6.0	☎ 32
Norton Antivirus	82
Super PC Kwik	43

HARD DISK MANAGEMENT

Norton Utilities 6.01	$109
PC Tools 7.1	96
QDOS III	41
SpinRite II	59
Stacker v2.0	☎ 79
Stacker /AT	178
XTree Gold 2.5	92

MEMORY MANAGEMENT

386MAX 6.0	$52
Desqview 386	128
Qemm 386	☎ 57

MENUING SOFTWARE

Power Menu Plus	$61

PRINT

Pizazz Plus	[illegible]
Print Q v5.0	79
Sideways v.3.3	☎ 54

SCREEN SAVERS

After Dark	☎ $27
Intermission	27

WORD PROCESSORS

Grammatik V	$35
LetterPerfect	129
MS Word 5.5	203
PFS ProWrite Plus	158
Rightwriter 5.0	53
WordPerfect 5.1	☎ 205
Word for Word (Windows)	[illegible]

"I wish to express my extreme pleasure with Telemart. I am one of your newer customers and I am sure that I will be using your firm for ALL my future computer purchases.

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Robert J. Turoff
Plattsburgh, New York
April 18, 1991

ACCOUNTING

ACCPAC BPI	
AP, AR, GA, INV Payroll	$230
DAC Easy Bonus Pack 4.2	122
DAC Easy Payroll 4.2	59
One Write + Acct. Works	169
Pacioli 2000	☎ 27
Peachtree III w/Data Query	211
TimeSlips III 4.0	183

COMMUNICATIONS

Carbon Copy Plus 6.0	$110
Co/Session Remote	70
Close Up Dual Pak	119
Mac Link Plus	119
Norton PC Anywhere v4.5	115
PC Anywhere III	79
Procom Plus v2.0	☎ 68
Prodigy Start-Up Kit 3.1	25
Winfax Pro	70

PROGRAMMING & LANGUAGES

Borland C++ App. Framework	$469
MS C Compiler	293
MS Fortran Compiler	266
MS Macro Assembler	[illegible]
MS Quick Basic	☎ 59
MS Quick C	59
MS Visual Basic	119

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- Order Processing (602) 944-1037
  10am 3pm Mon-Fri
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  Telemart, 8804 N. 23rd Ave., Phoenix AZ 85021
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  Software ONLY 30 days from date of invoice
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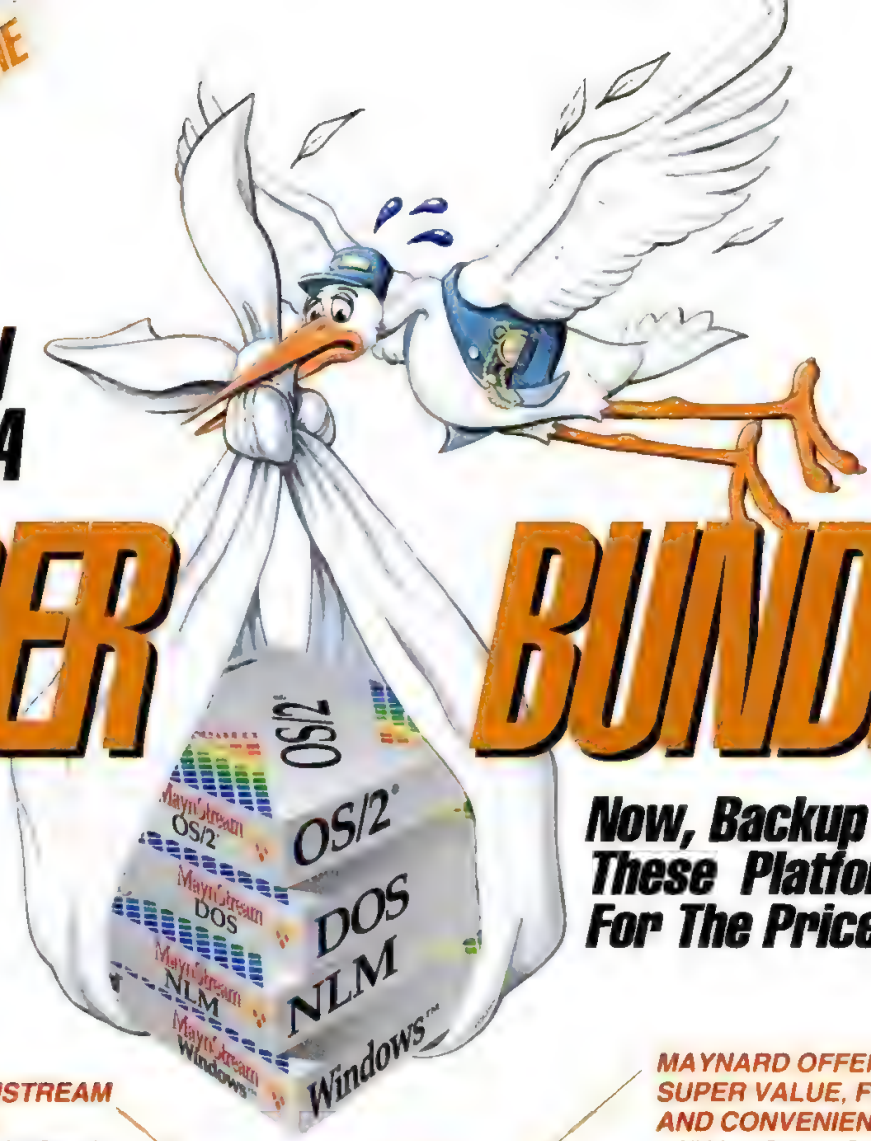

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CIRCLE 021 ON READER SERVICE CARD

William F. Zachmann

CDs Get On the Write Track

The computer world will be a better place when you can "write" your CDs as well as "read" them.

CD-ROM stands for *compact disk—read-only memory*. Standard CD-ROM drives use the same read-only technology found in CD audio players. But just as CD-ROM drives are finally being adopted, a more promising technology based on drives that can write as well as read standard CDs is in the offing.

Rapid growth in the use of CD-ROM drives is certain. My research suggests that by mid-decade more than one out of every three new computers sold will have a CD-ROM drive. And that is a very conservative estimate.

Certainly software distribution via CD-ROM is picking up momentum. A growing list of outstanding CD-ROM databases gives users compelling reasons to buy CD-ROM drives. Corel's *Artshow* provides a spectacular array of images for graphics designers. Bureau Development's edition of the *Monarch Notes* series is a student's crib-sheet dream. Computer Library's *S.O.S.* (*Support On Site*) is an all but indispensable tool for corporate PC support departments.

Obviously, CD-ROM has legs to carry it quite far, even as a strictly read-only medium. Nevertheless, any technology that makes it possible to write disks that can be read by the rapidly growing number of CD-ROM drives has tremendous possibilities. CD-R (Compact Disk Recordable) may very well be one of the hottest new technologies to come out over the next few years.

Standard CD and CD-ROM disks are read using a low-power laser beam. They are physically pressed from a mold created from a master disk. The original master disk is made with a special device that uses a high-power laser to burn microscopic holes into the master. The master is then physically copied to make the read-only CD audio or CD-ROM disks.

The two-step process to master and then duplicate the disks is relatively complex and expensive. It is not a practical means for ordinary users to write data to CD-ROM disks.

The newest CD-R technology, based on the Orange Book, Part II, specification and jointly developed by Sony (Japan) and Philips (Netherlands) makes it possible, at relatively low cost, to write disks that can be read by standard CD-ROM (or audio) drives.

A year ago Sony and Yamaha were making CD-ROM recorders that cost over $10,000 and could only write "once" in a single uninterrupted session. The new CDD 521/10 desktop multisession CD recorder from Philips Consumer Electronics adds another dimension by letting you append information to your CD.

The Philips unit is currently available for about $6,000. Blank disks currently cost about $25. Prices of both, however, will drop substantially over the next few years as the volume sold increases.

Lower prices for CD-R drives and media combined with software to support their use will soon make it possible for users to conveniently write CD-ROM disks. Meridian Data, for example, has announced *Netscribe*, a product due later this year that will provide LAN support for CD-R drives as extensions of standard DOS-style network file systems.

By this time next year, users will be able to use networked CD-R drives to create CD-ROM disks as easily as they presently write to standard magnetic floppy disks. That will open the door to a new range of backup and data distribution applications that can make use of the 600MB capacity of CD-ROM disks.

ILLUSTRATION: DAVID TURNER

As the volume of CD-Rs increase and prices fall, CD-R drives are likely to become inexpensive enough to replace read-only CD-ROM drives entirely. Long before that, however, CD-R will provide a way to get additional value from the growing installed based of CD-ROM drives. ■

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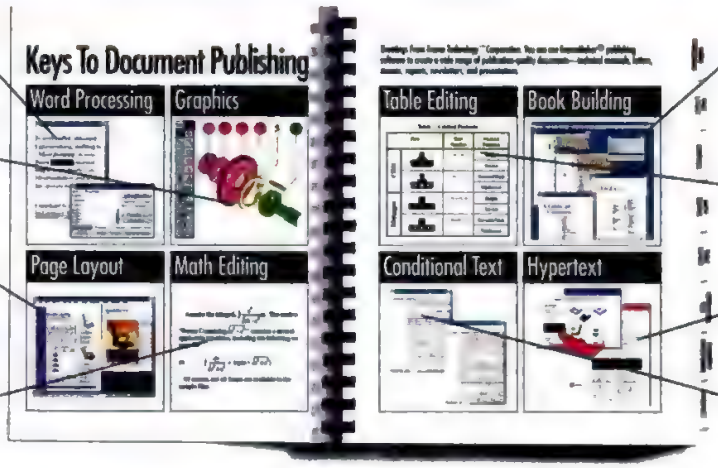

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CIRCLE 123 ON READER SERVICE CARD

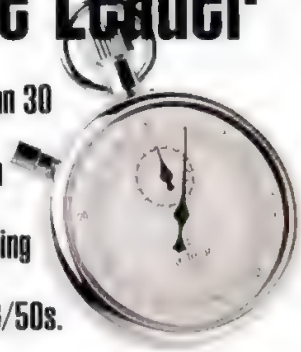
IN THIS REVIEW

- ACMA 486/50i
- Amax 486/50 ISAmax Power Station
- ATronics ATI 486B/50
- Axik Ace Cache 486/WB/50
- BOSS CEO
- C^2 Saber/50
- Club Falcon 450T
- Compaq Deskpro 486/50L
- CUI Advantage 486-50CX
- Dell PowerLine 450DE
- DT 486-50
- EPS 80486-50
- Intelec INT 486-50
- Mega Impact 486/50E
- National Micro Systems Flash 486-50C
- PCI 486-50C128
- Poly 486-50VF
- Silicon SVC 450DXC I2-510
- SST 486-50MWC

486/50

The New Performance Leader

Intel's latest speed demon, the 50-MHz 486, runs more than 30 percent faster than the 33-MHz 486. Yet systems based on this chip are selling for the same price a 486/25 was selling for a year ago. PC Magazine Labs tests 19 of the first 486/50s.



by John R. Quain

With the accelerating pace of performance progress among Intel processors, it's only a matter of a few months before the fastest PC is supplanted. The current performance leader on the PC platform is the 50-MHz 486DX. In this issue, PC Magazine Labs reviews 19 of the first 486/50 systems.

How fast is fast? A 50-MHz 486-based PC can run as much as one-third faster than PCs based on Intel's previous performance leader, the 33-MHz 486, according to PC Labs' benchmark tests. Furthermore, the 50-MHz 486 should continue to hold its own until the arrival late this year of systems based on the 586 (code-named P5). And even though the announced 486 CPUs based on Intel's speed doubler or clock doubler technology will provide performance that matches or even exceeds the 486DX/50s, these new chips won't offer a significant increase over the 50-MHz 486 in terms of overall performance. (For more information, see the sidebar "Speed-Doubler Technology.")

Equally steady is the progressive pace of declining prices. These 486/50 systems cost approximately the same as the 25-MHz 486DXs PC Labs reviewed a

year ago ("486/25: Entry to 486 Power," *PC Magazine*, June 25, 1991). The 486/50s run twice as fast and are better equipped with larger hard disks, cached disk controllers, and faster video subsystems. Compared with today's 486/33 PCs that are similarly equipped, you pay 10 to 20 percent more for 30 percent more performance. So while these 19 systems are not cheap, they are an excellent price/performance value.

THE FIRST 19: $3,000 TO $14,000

For this, *PC Magazine*'s first comparative review of 50-MHz 486DX-based PCs, we asked companies to provide systems with 8MB of DRAM, a 300MB hard disk, a Super VGA subsystem, DOS 5.0, and Microsoft Windows 3.0. The 19 vendors able to provide systems in time for this review are ACMA, Amax, ATronics, Axik, BOSS, C^2, Club, Compaq, CUI, Dell, Diamond, EPS, Intelec, Mega, National Micro, PCI, Polywell, Silicon Valley, and SST. Prices ranged from the Flash 486-50C's $3,064 direct selling price to the Compaq Deskpro 486/50L's $13,822 list price. Many other manufacturers, such as Advanced Logic Research, Austin Computer Systems, AST Research, Blue Dolphin, Blue Star Computers, Eltech Research, Hertz Computer Corp., Insight Computers, Mitsuba Corp., NCR Corp., NEC Technologies, Novacor, Systems Integration Associates, Tangent Computer, and Zeos International, were unable to meet our deadline for submissions but are now shipping 50-MHz 486DX systems.

WHERE 486/50s FIT IN

For many, the best PC is the one with the most throughput, which means today's 486/50 PCs. A 486/50 stands out both as a Windows power workstation (coupled with an accelerated or coprocessed video adapter) or as a file server on a large network (with an EISA bus). As you step down the performance ladder, purchase costs decline, but not as steeply as the falloff in performance. Excluding a handful of somewhat pricey name-brand systems that would skew the price averages (such as those from Compaq or Zenith Data Systems), you can find 33-MHz 486DX systems with selling prices in the $2,000 to $5,000 range, and 20- to 25-MHz 486SX and 33-MHz 386DX systems anywhere from $1,000 to $3,000. These prices are for somewhat less heavily equipped systems than the 486/50s reviewed here; for instance, they might have smaller, 200MB IDE hard disks rather than caching-controller 300MB units. As you descend still further into

OUR CONTRIBUTORS

Mario Baldasserini, Jim Beltran, and **Margaret A. Piemonte** are technical analysts of PC Labs.
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Bruce Brown is a contributing editor to *PC Magazine*.
John R. Quain is a frequent contributor to *PC Magazine*.
Robert Anthony is the editor of *Stadium Circle Features* and a contributor to *PC Magazine*.

PRICE/PERFORMANCE INDEX

Systems whose affordability and performance scores are better than average (a price below $5,200 and a performance/features score above 67) offer the best bang for the buck. Systems from six vendors meet these criteria: the ACMA, Amax, Axik, C^2, Club, and Polywell. The BOSS, Compaq, and Dell PCs turn in above-average performance scores, but they also cost more than average.

Of the six systems whose affordability and performance were better than average (those from ACMA, Amax, Axik, C^2, Club, and Polywell), all had ISA buses and fairly standard assemblages of high-performance parts. With the ACMA, Axik, and Club PCs, part of the extra value comes from large hard disks; with all but the Club, the performance/features scores are also boosted by very high WINBENCH scores (a result of their S3 chip–based video accelerators). The Axik and Club, meanwhile, turned in very high disk scores.

Each of these six systems also had a selling price below $5,200. Though the C^2 has a list price of $5,295, the system is sold in the dealer channel, and we have applied a 15 percent discount to approximate the street price. (The Amax and Polywell benefitted from this discount as well, but their list prices are $4,249 and $4,500, respectively—well below the $5,200 average.)

Though the BOSS, Compaq, and Dell received higher-than-average performance/features scores, they fall too low on the affordability axis to be considered bang-for-the-buck winners: The BOSS's selling price is $7,646, the Compaq's is $11,749, and the Dell's is $7,976.

THE DATA POINTS

The performance/features axis of the Bang for the Buck chart is based on 11 data points: the five PC Magazine Labs benchmark test scores, maximum installable RAM, disk capacity, VGA RAM, free slots, drive bays, and extras (miscellaneous items such as free bundled software, a mouse, on-site service, FCC Class B certification, an extended warranty policy, a 16550 UART, flash memory, and the availability of a 2.88MB floppy disk drive). We have applied a set of weighting factors to the raw numbers; performance and features each make up half the score. You can find this data in the Software Library of PC MagNet's Editorial Forum as 11BANG .WK1.

The tested-configuration price (as listed in each product's fact file) determines each system's *y*-axis location. We applied a 15 percent discount to the list prices of dealer-distributed systems to approximate street prices.

386DX/25 and 386SX systems, there is even less of a price falloff because a greater proportion of the system costs are fixed: the case, keyboard, and power supply, for instance.

SPEED-DOUBLER CHIPS

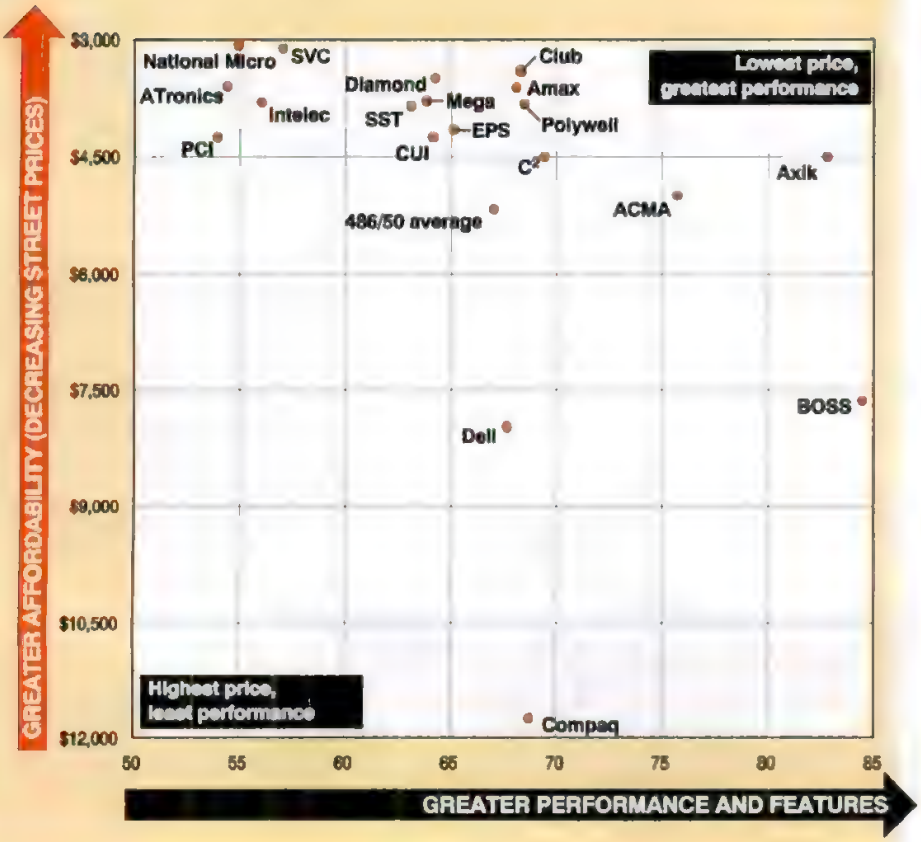
Intel's March introduction of the so-called speed-doubler or clock-doubler chips introduces additional performance and price options. The 486DX2/50 operates at 50 MHz internally and communicates with the local system bus at 25 MHz. It allows creation of a system based on a 486/25 design with much of the processor performance of a 486DX/50. On PC Labs' tests conducted on similar systems, the DX2/50's processor performance is virtually identical to that of the full-fledged 50-MHz 486DX. But once instructions are requested from outside the processor, the differences become apparent. The memory scores of the full 50-MHz system surpass those of the DX2/50 by roughly 30 percent.

Which chip is for what kind of user? I/O-intensive tasks will be held back by the DX2/50's 25-MHz bus access. That means the DX2 would not be the first choice for a file server. Conversely, standalone PCs running DTP or CAD software should not suffer from the slower local bus of the DX2/50.

The chips are priced within 10 percent of each other: DX2/50 chips cost vendors $517 each, and 50-MHz 486DX chips cost $570 each, both in 1,000-chip lots. Because more of the system operates at 50 MHz, full 50-MHz systems are more expensive to produce. Based on the first announced systems, price premiums have ranged from less than 10 percent up to 30 percent. As an example of tightly spaced pricing, Zeos separates identically outfitted 486DX/50 and 486DX2/50 ISA models by $100.

More DX2 chips are coming. Later this year Intel will offer a 486DX2/66 with an internal speed of 66 MHz and an external speed of 33 MHz. Though DX2/66 chip prices are expected to be higher than those of full-fledged 50-MHz CPUs, that increase will likely be offset by savings at the system board level, where the faster SRAM, chip set, and BIOS of full-fledged 50-MHz systems are not required. Preliminary tests conducted by PC Labs, using a DX2/66 sample, reveal that the new chip is capable of processor scores 20 to 30 percent better than the full-fledged 50-MHz chip. Once instruction requests are made outside the chip's Level 1 (internal) cache, however, the DX2/66's memory performance falls below that of the 50-MHz DX. Unlike the case of the DX2/50 versus the full 50-MHz 486DX, however, in most applications these performance differences will offset each other. And many users will find DX2/66 and 50-MHz 486DX performance equivalent.

The DX2-designated chips are for system builders. Users will be able to



HIGHLIGHTS

- PC Labs tested 19 486DX PCs with 50-MHz CPUs, 8MB of RAM, 300MB hard disks, DOS 5.0, and Microsoft Windows 3.0. These are among the first 50-MHz 486 PCs, with dozens more announced after PC Labs' testing deadline.
- 486/50s provide a performance improvement of up to 50 percent over the 33-MHz 486-based IBM PS/2 Model 90.
- Motherboards designed to support a range of 486 CPUs did not always perform as well as motherboards that run at 50 MHz only.
- Intel has announced 486 DX2 clock-doubler chips to upgrade existing 486 systems. The DX2 chips run at full speed inside the CPU and at half speed when connected outside the CPU. A 486 DX2/50 chip can be installed in a 25-MHz 486SX or 486DX system.
- Clock-doubler chips can be installed by the vendor when the system is built, or you can do it as an upgrade. The upgrade parts are called *OverDrive chips*. Depending on the system, the upgrades can replace the existing CPU or be installed in a socket alongside the old processor.
- The S3 video chip set appeared in 7 of the 19 systems in this review. Cards based on this GUI accelerator provide superior Windows performance and only adequate performance outside Windows.

upgrade their 16-, 20-, and 25-MHz 486SX and 25- and 33-MHz 486DX systems with DX2 variants Intel calls *OverDrive chips.*

IS IT UPGRADABLE?

If you buy one of these 19 PCs, buy it knowing that you may not be able to upgrade it. These systems have only the 168-pin 486DX socket and, on some systems, a socket for the Weitek math unit; they have no OverDrive socket for possibly faster CPUs, either a 100-MHz 486DX2 or the upcoming P5 chip. So unless the system has this 240-pin socket or a replaceable CPU upgrade card, you won't be able to move to the next performance level. For now, Intel is uncertain whether it will ever release a 100-MHz DX2, and if the company does, the 100-MHz chip may not work in existing 486DX systems because of heat and emissions issues. If you're bent on acquiring the 586 when it becomes available, make sure the system you choose conforms to Intel's 240-pin OverDrive socket specification.

DX/50 CONSTRUCTION

Intel's step up from the 33-MHz 486DX chip to a 50-MHz version required additional technical refinements. Both chips contain essentially the same processor logic, with a math coprocessor, an 8K memory cache, and 1.2 million transistors. In order to coax faster performance from the 486, the 50-MHz part uses a submicron (0.8 of a micron), three-layer chip design (versus the 33-MHz's 1-micron, 2-layer approach). The 50-MHz design reduces the size of the internal processor, narrowing and shortening the distances the electrical signals must travel within the chip.

After the 50-MHz 486DX introduction in June 1991, Intel ran into production problems when an unexpected number of flawed 50-MHz processors were produced. In August 1991, Intel halted shipments while it worked to improve manufacturing yields, according to the company. Intel resumed shipments within 60 days. Intel officials say there is "virtually no chance" of the early parts reaching buyers. Buyers can check by looking at the chip; the early samples lacked the enameled Intel logo.

NEW DESIGNS FOR 50 MHz

While Intel struggled with production headaches, many system-board manufacturers discovered that new motherboard designs were needed to meet the demands of the 50-MHz 486DX chip. Unlike the 33-MHz frequency, the 50-MHz point is a critical one. At this point the signal reaches higher into the radio frequency (RF) spectrum, causing potential interference for other motherboard components and signal feedback within the computer. (The signal propagation problems have been exaggerated, however. Television signals, for example, are broadcast between 54 MHz and 890 MHz, but leaving the cover off a 50-MHz 486DX will not interfere with TV reception in an adjoining room.)

Though Intel says 486/50s do not necessarily need a heat sink, many of the systems in this review came with one—or with a tiny fan that blew air over the CPU.

To address these issues, some designers had to make wider copper traces, reroute signal paths, and shorten electrical connections to the 50-MHz 486DX chip. Some system logic must also be moved closer together to minimize RF interference while leaving the CPU enough breathing room so that heat dissipation does not become a problem. Intel says there is no need to use a heat sink on a 486/50, although several systems in this review use a heat sink, or a tiny auxiliary fan blowing air over the chip, or both. Depending on placement of the CPU, the height of the heat sink may interfere with your ability to use all the slots in your system.

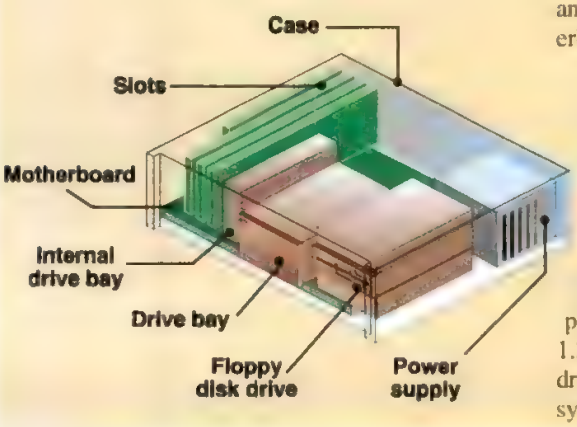
Furthermore, to exploit the performance gain of the faster chip fully, you usually need to replace several board components. Larger (256K), faster, and more expensive external static RAM caches are often used (12 to 25 nanoseconds), along with faster cache controllers. In some cases, you must change chip sets or discrete logic. And finally, the system clock crystal and BIOS must be upgraded.

MOTHERBOARD COMPONENTS

When choosing a 50-MHz PC, you need to look closely at motherboard components to ensure that the manufacturer has made the appropriate technology investment. Most critical to system performance is the memory and local-bus layout of a 50-MHz 486DX. Subpar memory performance often indicates that wait states are being introduced by a slow memory design interface.

On PC Labs' processor and memory benchmark tests, the 19 PCs were more alike than different. The ATronics ATI

A GUIDE TO THE SYSTEM CONFIGURATIONS



Case Options include desktop, tower, mini-tower, small-footprint, and slimline.

Slots The number and length of cards represent the number and length of slots on the motherboard.

Drive bay A hard disk face plate indicates external access to a bay. Options include full-height, half-height, third-height, and 3.5-inch.

Floppy disk drive A face plate indicates that either a 1.2MB or 1.44MB floppy disk drive was installed in our tested system.

486B/50 and Compaq Deskpro 486/50L were first on the processor and memory tests, respectively, but not by significant margins. Three systems showed performance below the rest, though: the SVC 450DXC I2-510, CUI Advantage 486-50CX, and Club Falcon 450T (with the greatest falloff in performance) on the processor test; the Club Falcon 450T, PCI 486-50VF, and BOSS CEO on the processor test. Falloff on the memory test was more pronounced than on the processor test.

PC Labs' tests show that a well-implemented write-back SRAM cache with fast control logic, such as Intel's expensive 82495DX-50 external cache controller in the Compaq Deskpro 486/50L, will deliver the best performance on a 50-MHz 486. Systems that performed well on the processor and memory tests in this review, such as the Compaq PC, typically use a write-back external cache with 256K of SRAM. In general, a write-back cache is slightly faster than a write-through cache, and a posted, or buffered, cache falls in between. Note, however, that a good write-through implementation can surpass more expensive but poorly implemented write-back designs.

Unlike slower 25-MHz and 33-MHz 486 designs, the increased local-bus activity of the 50-MHz DX can benefit greatly from larger processor RAM caches—even above the typical 256K maximum, according to Intel. The reason for this is that when an internal cache miss occurs and the 486 requests an instruction from outside the chip, any delays on the local system bus will introduce additional wait states, due to the processor's faster clock cycle. Consequently, those machines using only 64K cache designs fell substantially behind the leaders on our benchmark tests.

ACCELERATED GRAPHICS

The most obvious performance differences between the 50-MHz systems reviewed here will be immediately noticed by Windows users. Our new WINBENCH Windows test results split the systems into two groups: those with GUI video accelerators (nine systems) and those without (ten systems). The performance difference between the two types can be as much as 10 to 1. Seven PCs used boards based on the S3 P86C911 accelerator chip, and these PCs finished first through seventh: the SST, Axik, Polywell, C^2, Mega, EPS, and Amax. The ACMA was eighth, with the ATI Ultra card, and the Compaq was ninth, with its accelerated EISA VGA card. Both are accelerator designs. The others used older Tseng or Trident nonaccelerated (so-called dumb frame buffer) designs that actually fared better on the non-Windows video test than the S3 chip–based systems. Of the two, we believe Windows performance is the far more important criterion in choosing a video card, since even a comparatively slow card running outside Windows should be more than adequate. Without some form of video accelerator or coprocessor, a 50-MHz 486DX will actually appear slower on many Windows tasks than an accelerator-equipped 33-MHz 486DX.

An accelerated video adapter will add only $65 to $100 to the system price. Several companies plan to offer further video performance enhancements this summer with local-bus video designs using accelerators from Texas Instruments, Chips and Technologies, and Western Digital.

Network managers should look for EISA machines with tower cases and large power supplies that can support five or six network cards.

CHANGING DRIVE TECHNOLOGIES

Among the 19 systems, we received 12 with IDE hard disks, 4 with SCSI hard disks, 2 with more advanced SCSI-2 units, and 1 with an ESDI unit. Several new drive technologies appeared on systems in this review; the most significant:

- Memory caches on IDE hard disks. The ACMA and Amax systems use the 425MB Quantum ProDrive 425A with a 256K cache. Don't confuse this cache with the much less sophisticated track buffers on other units.
- Disk caches on IDE hard disk adapters on the ACMA, Amax, ATronics, Axik, C^2, Club, and CUI systems.
- A 386SX coprocessor on the BOSS PC's AMI SCSI-2 EISA caching disk controller. While the 386SX is a long way from state-of-the-art performance as the PC's main CPU, it does wonders overseeing the hard disk: On our disk test, the BOSS was three times as fast as the second-fastest PC and seven times as fast as the slowest system.

Users should take these results with a grain of salt. Our tests are designed to measure hard disk and controller performance in a laboratory setting rather than in the real world. We test the hard disks with any cache built into the drive or drive controller/adapter. No software-based disk cache, such as SMARTDRV, is included in the tests because if one were, there would be very little performance difference to discuss. We recommend use of a software cache unless you have a hard disk controller with significant amounts of on-board cache memory (2MB to 4MB). Note also that while SCSI is in many ways superior to IDE, for nonserver applications users should find current IDE technology combined with a hardware or software cache (or both) to be more than adequate.

486/50s AS SERVERS

If you are shopping for a file server, make sure you choose a tower case with plenty of room for expansion and ventilation. LAN managers should also look to this roundup's EISA machines with large power supplies. The wider, 32-bit EISA bus can eliminate data congestion on a server, and a 300-watt power supply should ensure that five or six Token-Ring cards will operate without incident. Of the 19 tested PCs, 5 had EISA buses: the BOSS, Compaq, Dell, Diamond, and Mega. The remainder were ISA-bus systems; there were no MCA systems in this roundup.

Only four of the 19 systems reviewed here were *NetWare*-certified at the time of PC Labs' testing—Diamond, EPS, Mega, and Polywell—owing to the newness of the 486/50 category. The certification process generally takes from two to eight weeks, according to Novell. Lack of *NetWare* certification does not mean a PC won't capably run *NetWare;* some smaller vendors dislike the expense involved (Novell charges several thousand dollars). But on the whole, you probably should look for *NetWare* certification.

REVIEW CRITERIA

To be included in this review, we required a shipping 486DX/50, not a speed-doubled DX2/50. DX2/50 systems will be reviewed in an upcoming issue. The system had to be shipping as of late January 1992 (seven months after the June 24, 1991, announcement of the 50-MHz chip and more than three months after Intel resumed shipments of stable 50-MHz parts). To ensure systems were shipping to buyers (and not just magazine reviewers or a handful of select corporate evaluators), *PC Magazine* placed blind calls, posing as PC buyers seeking to order a handful of systems. If a vendor could not meet that criterion or provide an adequate explanation (such as a parts shortage that temporarily backed up orders of shipping systems), we excluded its system from this roundup.

The standardized system we sought included 8MB of RAM, a 300MB hard disk, two floppy disk drives, a Super VGA monitor and video card, DOS 5.0, and Microsoft Windows 3.0. The vendors chose the amount of external processor RAM cache. Some vendors that submitted systems late in the review cycle supplied 400MB-plus hard disks; in order to complete the reviews, we accepted these also. The choice of case (tower or desktop) and bus architecture (EISA, ISA, MCA) was left to the vendor.

In addition to the 19 systems reviewed, as of our deadline more than a dozen additional vendors said they are now shipping 486/50s. If you look for systems that offer more than a standard assortment of off-the-shelf components, you should be able to find the ultimate power PC.

EDITORS' CHOICE

■ **Dell PowerLine 450DE**

When you're shopping for a top-of-the-line computer, you should look for one with solid construction, sound technology, an EISA bus, and a strong company behind it. Of the 19 50-MHz 486-based PCs in this review, the Dell PowerLine 450DE and the Compaq Deskpro 486/50L best meet these criteria. The PowerLine 450DE merits an Editors' Choice designation and the Deskpro 486/50L deserves an honorable mention. Compaq's $13,000 list price stops us from giving this system the Editors' Choice distinction.

The strength of the Dell and Compaq systems lies in their rugged construction and the technology on their motherboards, not in the souped-up components (such as coprocessed disk drive controllers) that inflated some of the scores in this roundup.

Much of the PowerLine 450DE's circuitry—I/O ports, video, and IDE—is built right onto the motherboard, although you can disable any built-in component and optimize your system with a higher-performance add-on. We also liked this PC's small-footprint case, which helps it save space on your desktop. (Only one other PC, the SST 486-50MWC, featured such a case.) If you are looking for a server, Dell does offer a tower configuration with 11 drive bays. Finally—and just as important as the system itself—the PowerLine 450DE has FCC Class B certification and comes with Dell's top-notch service and support behind it; in the 1992 *PC Magazine* Service and Reliability Survey, Dell was consistently among the top-rated vendors.

HONORABLE MENTION: COMPAQ

The Deskpro 486/50L also features a highly integrated motherboard and is the only system in this group to use Intel's A82495DX-50 write-back cache controller, which employs the MESI (modified, exclusive, shared, and invalid data) caching protocol, and a 256K two-way set-associative cache for better memory performance. While there was virtually no difference in processor score among the 19 systems, the Deskpro 486/50L did turn in the best score on PC Magazine Labs' memory benchmark test: nearly 25 percent above the average of all systems in this review. The Compaq PC accomplished above-average performance on the processor, memory, and video tests, and performed better on our disk test than six of the seven other systems with uncached disk controllers. The system's biggest drawback is its price: $13,822 (list) for a system with 8MB of RAM, a 340MB hard disk, a tape backup drive, on-board Super VGA color display circuitry, DOS 5.0, and Microsoft Windows 3.0. That's still a street price of nearly $12,000 and still more than $11,000 without the tape backup unit. In recent months, Compaq has become more aggressive on pricing, but we believe there is still room for improvement.

SPEEDY COMPONENTS

Some of the systems in this review have fast components that brought their scores well above the group averages. The BOSS CEO, for instance, came with a caching AMI Fast Disk, a controller that comes with its own 386SX/16 processor on-board; it boosted disk performance nearly threefold over Axik's Ace Cache 486/WB/50's second-best score. Nine systems came with accelerated graphics cards that boosted their Windows performance.

Six systems fared well on both the affordability and performance axes of our price/performance index: the ACMA 486/50i, Amax 486/50 ISAmax Power Station, Ace Cache 486/WB/50, Club Falcon 450T, C^2 Saber/50, and Poly 486-50VF. Of those, the Poly stands out because of its solid construction, $4,500 price tag, high performance, and generous feature set (which includes accelerated video, a tower case, a low-radiation monitor, and a two-year warranty plus five years on parts and labor). Though you could choose a low-priced, high-bang-for-the-buck system like the Poly, we believe that if low cost is paramount, you should consider the clock-doubled 486DX2s now hitting the market. The DX/50s can be as much as 30 percent more expensive than some of the DX2-based systems that have recently entered the market.

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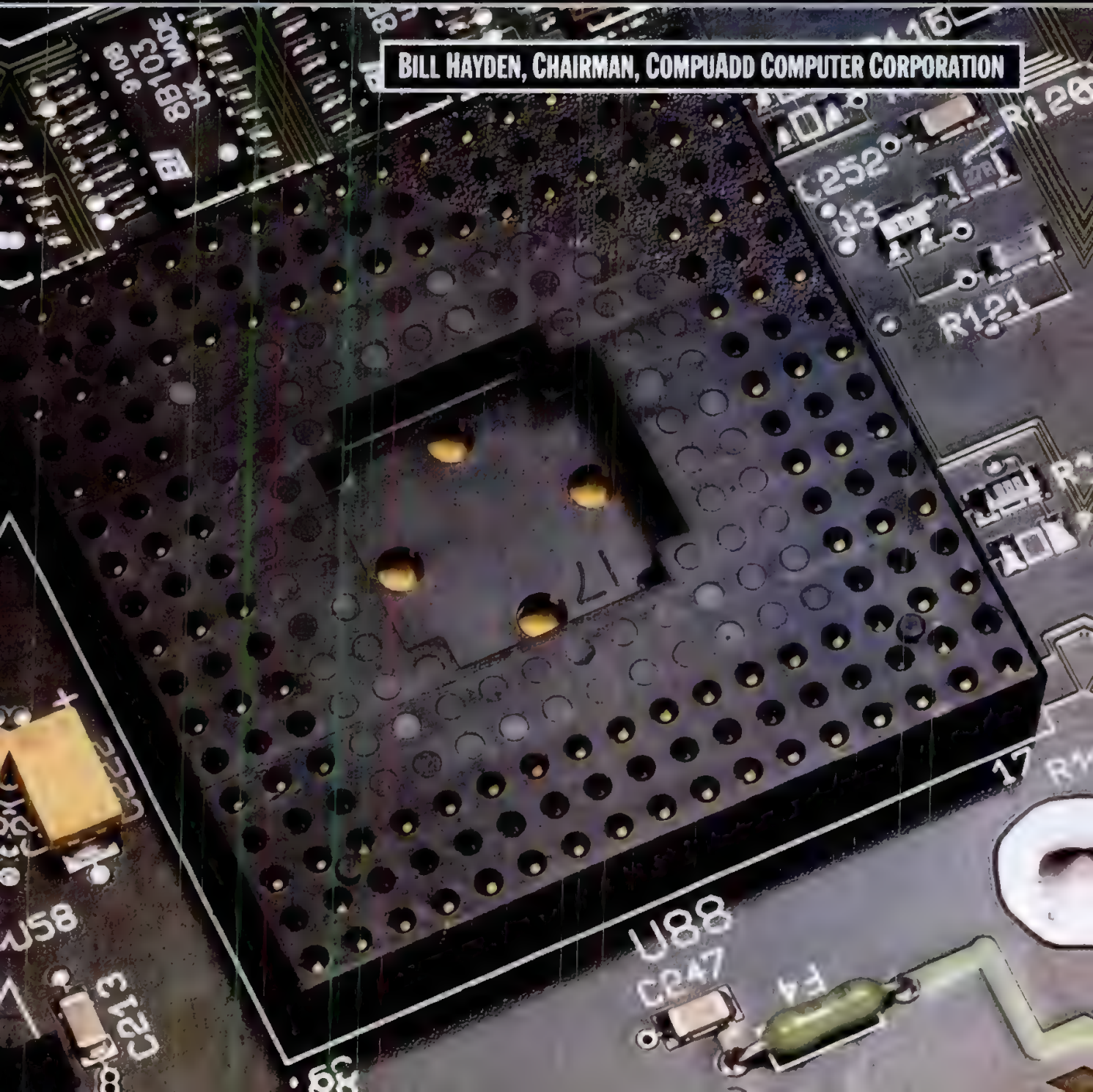
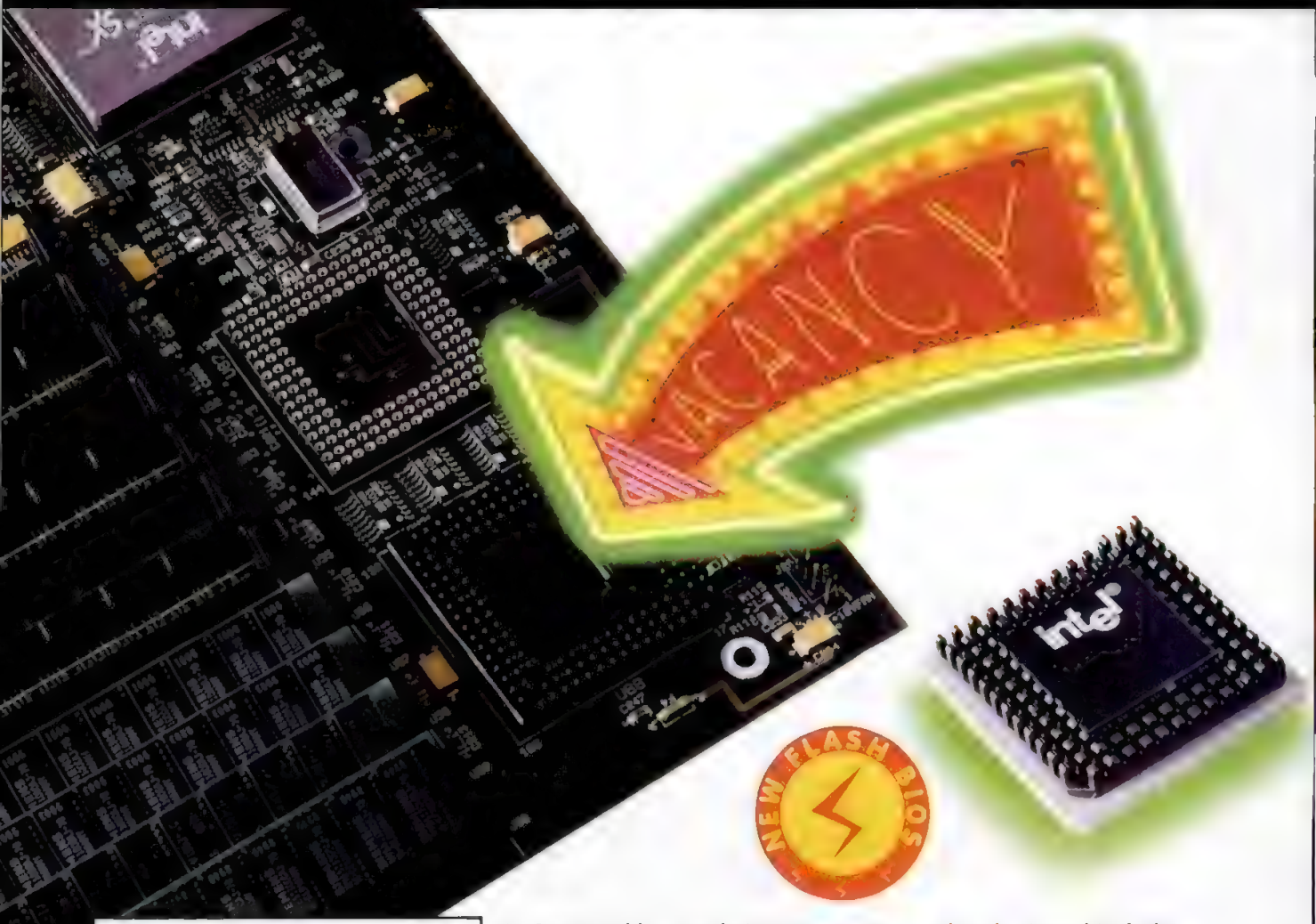
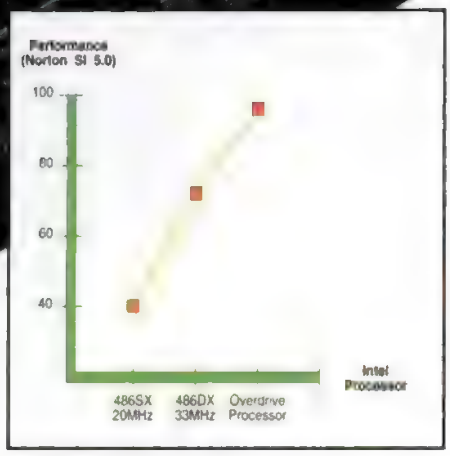


"AS TECHNOLOGY WON'T HAVE TO LEAVE





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ACMA COMPUTERS INC.

ACMA 486/50i

by Bruce Brown

The ACMA 486/50i, an ISA tower, is a good choice for applications that call for lots of data storage and relatively high throughput. While it wasn't the fastest on any of our tests, this PC is a capacious unit and a respectable performer.

The $4,995 ACMA we tested came with 8MB of RAM, a 256K cache, a 425MB IDE hard disk, and a coprocessed video card; these all fit inside a 24.5- by 7.5- by 17.3-inch (HWD) tower case with room for eight drives. This configuration is less expensive than one with a 340MB hard disk, which would have met the configuration we requested: ACMA Computer's 340MB ESDI model carries a list price of $5,095, and a SCSI model costs $100 more.

ACMA 486/50i, $4,995

The ISA motherboard, made by Helm Engineering, incorporates an AMI BIOS and SIS support chip sets, including a SIS controller for the 256K RAM cache. Though ACMA says Helm makes the motherboard to ACMA's own specifications, the board and its accompanying documentation are identical to those found in the Amax 486/50 ISAmax Power Station. You can install up to 32MB in the eight SIMM sockets, then add 32MB more on a $100 proprietary memory card. Five of the motherboard's eight slots for add-in cards were free.

SOLID COMPONENT RATINGS

The 425MB 14-millisecond Quantum ProDrive 425A IDE hard disk is matched to an UltraStor Ultra 15C disk controller that has its own 4MB disk cache. The ATI Ultra video card, with its ATI Mach 8 coprocessor and ATI 38800 chip set, placed the machine in good stead in terms of graphics and text performance; the 17-inch Seiko CM1760LR display, with a maximum 1,280-by-1,076 noninterlaced resolution and a 75-Hz refresh rate, is particularly suited to Microsoft Windows users.

The ACMA turned in average processor and memory benchmark test scores. Its video subsystem, based on the ATI Ultra video adapter, registered average scores on the video and WINBENCH tests. The Quantum ProDrive 425A hard disk, with its 4MB cache, achieved a disk score that ranked it among the top three machines that do not have a separate processor on the controller.

This PC is not currently *NetWare*-certified, and ACMA does not sell the drive arrays increasingly found on file servers. The company is preparing some hardware and software option packages for small-size networks, but details were not available at the time of this review.

ACMA's documentation combines an original section on general system information with a collection of manuals for the included components; the organization and information are very similar to that of the Amax system we reviewed. The system's one-year parts-and-labor warranty is augmented by toll-free technical support and free one-year on-site service from TRW. Sold via mail-order, the ACMA comes with a 45-day money-back guarantee.

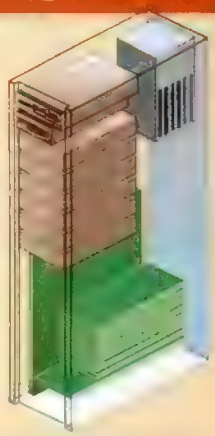
PC LABS' BENCHMARK RELEASE 6.0

ACMA 486/50i

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	527	438	532	514
Memory	8,044	4,283	9,903	8,017
Disk	470	81	1,976	352
Video	2,661	1,360	4,417	2,605
WINBENCH	8,157	1,985	12,428	6,087

In Short: High data throughput makes the $4,995 ACMA 486/50i ISA tower an appropriate choice as a file server or high-speed single-user machine. It placed among the top performers on our processor, memory, and disk tests and scored about average on the video and WINBENCH tests.

PC FACT FILE



ACMA 486/50i
ACMA Computers Inc., 48501 Warm Springs Blvd., Fremont, CA 94539; 800-456-1818, 510-623-1212; fax, 510-623-0818.
List price (tested configuration): $4,995.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Quantum 14-ms. 425MB IDE hard disk, UltraStor controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: ATI 1,024-by-768 adapter with 1MB RAM, Seiko 17-inch monitor, 75-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 487 ON READER SERVICE CARD

AMAX ENGINEERING CORP.

Amax 486/50 ISAmax Power Station

by Bruce Brown

The Amax 486/50 ISAmax Power Station makes a good workstation in demanding situations, such as engineering use. Five drive bays make it less appropriate as a file server, but its well-chosen storage and video components deliver good performance for a variety of applications. Possible discounts from the dealers and VARs who sell this system will make its $4,249

PC LABS' BENCHMARK RELEASE 6.0

Amax 486/50 ISAmax Power Station

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	527	438	532	514
Memory	8,064	4,283	9,903	8,017
Disk	476	81	1,976	352
Video	1,855	1,360	4,417	2,605
WINBENCH	9,600	1,985	12,428	6,087

In Short: Though its desktop case has only five bays, the $4,249 Amax 486/50 ISAmax Power Station is good as an engineering workstation or for other demanding uses. Its drive throughput is excellent, as are its processor and memory scores. Video performance, typical of the system's S3 accelerator, was above average on the WINBENCH test and below average on the video test.

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CIRCLE 020 ON READER SERVICE CARD

Amax 486/50 ISAmax Power Station, $4,249

price even more attractive.

Amax Engineering Corp. puts an ISA-bus motherboard, manufactured by Helm Engineering, into a 6.5- by 21- by 15-inch desktop case. The system we reviewed came with 8MB of RAM, a 256K cache, and a 425MB hard disk; a 340MB system would sell for $4,149.

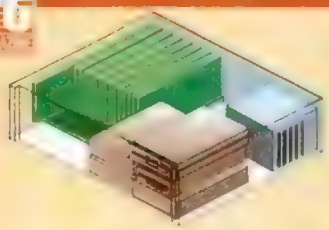
The motherboard, which appears identical to the one ACMA Computers uses in its tower, incorporates an AMI BIOS and a SIS support chip set with a SIS controller for the direct-mapped, write-through cache. Neither the I/O ports nor the video adapter are integrated onto the motherboard, so the cards for these functions, plus the hard disk controller card, take up three of the eight expansion slots. The unit has five drive bays, three for removable media. The system's maximum 64MB memory capacity consists of 32MB on the motherboard itself, with 4MB SIMMs in the eight SIMM sockets, and another 32MB on an optional $72 memory expansion board. Amax has no program for trading in SIMMs, though individual dealers may.

The Power Station's UltraStor Ultra 15C's IDE caching disk controller has 4MB of RAM paired with a 425MB 14-millisecond Quantum ProDrive 425A hard disk, which has its own 256K cache. This combination makes possible quick accesses and good throughput. A Diamond Stealth VRAM video card with an S3 graphics accelerator, and a 15-inch NEC MultiSync 4FG monitor with a 70-Hz refresh rate at 1,024-by-768 noninterlaced resolution, make a good all-purpose combination.

The Power Station attained average processor and memory scores. Its test scores on PC Magazine Labs' video and WINBENCH benchmark tests were also average—a balance that speaks well for the performance of the video board because good scores on one test are often linked to low scores on the other. This PC's disk score was among the top for systems that had controller cards without a separate processor chip, pointing out the advantage of the speedy hard disk and cached controller card. The Power Station is not *NetWare*-certified, although the vendor does sell Version 3.11 of *NetWare* and *NetWare Lite*. No drive-array option is offered at this time.

All Amax systems come with a one-year parts-and-labor warranty with one-year on-site service by TRW. Technical support, available weekdays and Saturdays from 7:00 to 6:00 P.S.T., is not toll-free. The documentation adequately combines a description of the system and manuals for separate components, such as the motherboard. Like the motherboard, the documentation strongly resembles that of the ACMA 486/50i.

FACT FILE



Amax 486/50 ISAmax Power Station
Amax Engineering Corp., 47315 Mission Falls Ct., Fremont, CA 94539; 800-888-2629, 510-651-8886; fax, 510-651-3720.
List price (tested configuration): $4,249.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Quantum 14-ms. 425MB IDE hard disk, UltraStor controller, 4MB cache, 1.2MB or 1.44MB floppy disk drive.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, NEC 15-inch monitor, 70-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 488 ON READER SERVICE CARD

ATRONICS INTERNATIONAL INC.
ATronics ATI 486B/50

by Margaret A. Piemonte

First you'll notice the mini-tower case, then the removable-hard-disk handle. If space is a problem—or if security demands that you treat your hard disk as removable media—the ATI 486B/50 is a good choice.

PC LABS' BENCHMARK RELEASE 6.0

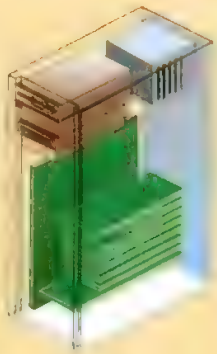
ATronics ATI 486B/50

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	532	438	532	514
Memory	8,359	4,283	9,903	8,017
Disk	327	81	1,976	352
Video	1,391	1,360	4,417	2,605
WINBENCH	2,062	1,985	12,428	6,087

In Short: You may want more than the five drive bays you will find in this ISA mini-tower, but the $4,230 ATronics ATI 486B/50 saves space and has a removable hard disk. It placed among the top processor and memory performers; its disk speed was average, though its video and WINBENCH scores were on the low side.

The $4,230 ATronics came with 8MB of RAM, a 256K cache, and a 340MB hard disk. Its case measures 13 by 7 by 16 inches and contains five drive bays: four front-accessible and one internal half-height. (ATronics International offers a desktop case for $15 less and a standard tower for $60 more.) The ISA-bus motherboard has eight slots: six 16-bit, one 8-bit, and one proprietary 32-bit. Four of our test unit's slots were empty, and of the four, only two could accept full-length boards. This somewhat-limited expansion, coupled with an ISA-bus design, should

FACT FILE



ATronics ATI 486B/50
ATronics International Inc., 45635 Northport Loop East, Fremont, CA 94538, 800-488-7776, 510-656-8400, fax, 510-656-8560
List price (tested configuration): $4,230.
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms. 340MB IDE hard disk, Promise Technology controller, 4MB cache, 1.2MB or 1.44MB floppy disk drive.
Display: Trident 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 56-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 489 ON READER SERVICE CARD

The dot matrix era is over.

PC MAGAZINE EDITORS' CHOICE
November 26, 1991
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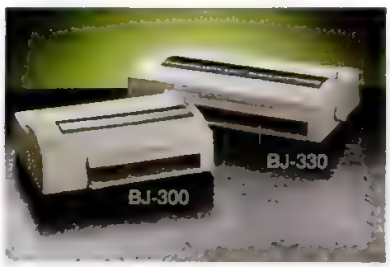

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CIRCLE 155 ON READER SERVICE CARD

ATronics ATI 486B/50, $4,230

make you think twice about choosing the ATronics for network use.

The company makes its own motherboard, which can take 32MB of RAM and can accept a 32-bit proprietary memory board that adds another 32MB, bringing the system maximum to 64MB. All eight SIMM sockets were filled with 70-nanosecond 1MB DRAM SIMMs. Our test unit also came with 256K of 20-ns. secondary SRAM cache with a direct-mapped/write-back policy.

The ATronics ranked first on PC Magazine Labs' processor benchmark test but only slightly above average on our memory test. The motherboard, designed to be upgradable from 486SX/20 to 486DX/50, may have a memory implementation geared toward an average of these processor classes rather than optimized for the high end. With a 486/50 processor, the motherboard requires two wait states.

ATronics configured its machine with a 15-ms.-rated Maxtor LXTAT340A IDE hard disk. A handle, which the company adds to all of its hard disks, lets you treat

SPEED-DOUBLER TECHNOLOGY

DX2 and OverDrive chips make most 486 PCs, 16-MHz through 33-MHz, upgradable. Because the CPU runs twice as fast, your PC almost doubles its speed. This is one more reason to consider a 486 over a 386. (Take *that*, AMD.)

by John R. Quain

What's a user to do? Your PC lasts five years, yet there's a new generation of CPUs every year or so. In the past, users in search of more CPU performance replaced crystals on early 6-MHz IBM PC ATs to drive them at 8 MHz, installed turbo boards, even replaced motherboards. More recently, vendors have offered replaceable processor/memory modules. In most cases, the performance boost was modest or the cost was a healthy fraction of the price a whole new system would cost. But now there's a PC upgrade that makes sense.

Enter the speed-doubler, or clock-doubler, technology for 486 systems, announced in March. Chips based on this technology come in two versions, DX2 and OverDrive CPUs. They run at one speed inside the processor, say 50 MHz, and at half that speed when addressing system memory. The technology works on Intel 486DX and 486SX CPUs running at 16, 20, 25 or (later this year) 33 MHz. There is a confusing array of speed-doubler chips to choose from. Here is one way to understand the technology; it is based on what kind of computer you have or will buy:

- **You buy a new PC with DX2 technology.** You can buy a 486DX2/50 system now and, later this year, a 486DX2/66. The DX2/50 should cost less while offering almost as much performance as a full 486/50 system.
- **You upgrade a 16-, 20-, or 25-MHz 486SX PC through the OverDrive socket.** There will be one OverDrive chip for 16- and 20-MHz 486SX systems ($549) running at 16/33 MHz or 20/40 MHz, and another for 25-MHz SX machines ($699) running at 25/50 MHz. These chips fit in the vacant 169-pin "performance upgrade socket" touted in Intel advertisements. This socket has also been called the math coprocessor, processor upgrade, and OverDrive socket. When you plug in the new CPU, the existing CPU does no processing.
- **You replace the CPU in 25- and 33-MHz DX systems with a 168-pin OverDrive chip, which Intel plans to release later this year.** These systems don't have an enhancement socket, so you remove the existing CPU from its 168-pin socket and replace it. There will be 50- and 66-MHz 168-pin OverDrive chips for existing 25- and 33-MHz systems. Intel has not determined whether there will be 100-MHz upgrades for DX/50 systems such as the 19 systems that are reviewed in this issue. Intel is testing older 486DX models for BIOS compatibility and will print a list of 486DX systems that can accommodate dual-speed CPU replacements.

There are no OverDrive or DX2 options for 386 systems, which is just fine with Intel. Intel would rather see you using a 486 (except for the laptop-oriented SL variant of the 386SX) now that AMD has successfully cloned the Intel 386.

TECHNOLOGY BEHIND DX2

DX2 and OverDrive chips are all based on the same submicron technology used in the 50-MHz 486DX. The DX2, for example, contains 1.1 million transistors in a three-layer, 0.8-micron circuit-line form. The 486's internal 8K cache, integer, and floating-point units all run at the faster speed, which is 50-MHz in the case of the DX2/50. External communication with the PC runs at half the rated speed, 25 MHz for the DX2/50, to maintain compatibility. In order to get the slower system bus to talk to the faster CPU, the dual-speed 486s use a phase-locked loop (PLL) circuit and an analog amplifier. In the case of the DX2/50, the speed of incoming 25-MHz signals received from the local system bus is calculated by the PLL circuit and then amplified and synchronized with the internal 50-MHz signals. Outgoing signals are divided by 2 within the CPU and then fed to the bus interface.

Since the local system bus typically includes system memory (DRAM), external cache memory (SRAM), the system BIOS, and controller logic, speed-doubled 486s will have no effect on these components. This means

the disk as if it were removable media. An extra-cost option, Promise Technology's DC-2030 hard disk caching controller with 4MB of RAM, gave middle-of-the-road performance on our disk test.

The ATronics fared less well on our video test, where its Trident TVGA 8900B chip set had to compete with the fast Super VGA and GUI accelerators in our test group. This subsystem performed poorly on our video and WINBENCH tests. Though these results render the ATronics less suitable than some other systems for high-end CAD, a different video adapter would fix the problem. While the Trident video adapter and chip set support 1,024-by-768 resolution, the highest noninterlaced resolution that the ViewSonic 4E monitor can handle is 800-by-600 with a 56-Hz refresh rate.

ATronics offers a one-year warranty on parts and labor and ships parts for customer installation. The company mirror-ships repaired units, paying return shipment costs. On-site service from Nationwide is a $99 option. Unlimited free technical support is available weekdays from 8:00 to 5:00 P.S.T.

AXIK COMPUTER INC.

Ace Cache 486/WB/50

by Dan Smith

Axik Computer's Ace Cache 486/WB/50 is a moderately priced ISA machine with a caching disk controller and accelerated video that charged both its disk and video performance.

that none of these components should have to be changed on a 25-MHz 486 system board to accommodate the faster dual-speed chip. Thus, a significant performance gain can be achieved without raising any of the signal propagation issues or requiring the more expensive components of a full-fledged 50-MHz 486DX.

HOW FAST WILL A DX2 PC RUN?

A 50-MHz 486DX PC will be faster than a DX2/50 system. First, because the local bus access of DX2/50 chips is only half the speed of identically rated DX 486s, access to memory and BIOS information on a DX2/50 will be slower than on a 50-MHz 486DX. Also, performance gains provided by speed-doubled chips vary depending on the software application and—in the case of OverDrive upgrades—how the original motherboard was designed. Intel's claimed "as much as 70 percent" performance increase for the OverDrive units, for example, refers to upgrades in 486SX PCs, which don't ave math coprocessors.

The 66-MHz DX2 might perform to 30 percent above the 50-MHz DX ign. That depends, however, on how n the processor must go outside the 's internal cache to seek instruc- On PC Magazine Labs' bench- ts, which register a significant of such cache misses, a sample ins speed on the processor s down when it comes to and writes, resulting in is about equal to that 6DX.

As systems designers work with the new DX2/66s, however, they may be able to reduce processor wait states, making the 33-MHz bus interface more effective in dealing with the CPU's 66-MHz clock speed. Memory timings and controller logic will prove to be more critical in DX2 systems than on previous DX and SX models. The reason: Calls from the DX2 to the local system bus occur at twice the rate of the bus. When those calls are made, even if the external, say, 33-MHz bus has zero wait states, it will create two to three wait states in the processor—within tolerable limits for the CPU core. But if the external local bus introduces even one wait state of its own, it will cause four or five processor wait states. Therefore, the bus design can substantially inhibit performance—and the effectiveness of OverDrive upgrades.

POTENTIAL PROBLEM AREAS

Upgrading a 486 with a dual-speed 486 also may involve BIOS conflicts, heat dissipation issues, and FCC certification status. Users with older 486 designs may have to upgrade their PC's BIOS, though such cases should be rare. The problem has to do with older BIOSes that rely on timing loops (based on the processor's speed) for managing peripherals. The heat created by faster processors is a prickly issue as well. Intel, for its part, says the DX2 speed doublers do not require special heat sinks in a properly ventilated system. A DX2/50 chip, for example, uses only about 50 milliamps more power than a 33-MHz DX. But because OverDrive upgrades are intended for a variety of systems—including small desktop systems crammed with expansion boards—a heat sink attachment will be standard. You can expect to see even larger heat sinks attached to 66-MHz DX2s.

Any time you change a major component, such as the CPU, the system needs a separate FCC certification. Most motherboard manufacturers have decided to anticipate upgrades and submit identical boards populated with different Intel CPUs. As for users who choose to upgrade older 486 systems, it is extremely unlikely that OverDrive upgrades will cause any signal emission problems.

586 OVERDRIVE COMING?

Choosing among all the 486 flavors may prove difficult as 486 PC price differentials drop below $100. The level of customer consternation will surely rise another notch as 240-pin OverDrive sockets appear on DX2 PCs. This new vacancy is not compatible with the current OverDrive sockets on 486SX systems, nor is it compatible with any chips Intel currently sells. Though Intel spokespeople will say only that the 240-pin socket is for "future upgrades," it doesn't take a marketing guru to realize what the next step is. Intel's introduction of its next-generation processor, called the P5, has been anticipated for months. Some expect the first P5 or 586 chips to appear this year. And guess how many pins it will have? ■

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System Requirements • IBM® PC/XT™, AT®, PS/2® or other fully compatible computer • 640K RAM • DOS 3.1 or higher • CD-ROM drive with CD-ROM extensions for Microsoft® MS-DOS® (Version 2.0 or higher).

Our $4,499 tested configuration, with 8MB of RAM and a 340MB hard disk, came in a 24.5- by 7- by 16.5-inch tower case that holds eight 5.25-inch drive bays: six external and two internal. The ISA-bus motherboard, manufactured by Axik Computer, contains nine slots: eight full-length 16-bit and one proprietary 32-bit slot for Axik's own local-bus Windows accelerator, the Ace Point 32, which is not yet available.

The motherboard contains an AMI BIOS, a coprocessor socket for a Weitek 4167, and a Contaq chip set with an Axik label. You can configure the 1MB 80-nanosecond SIMMs to have zero wait states in an interleaved page-mode memory scheme. Using 4MB modules will give you 32MB on the motherboard; the system maximum is 64MB. PC Magazine Labs' processor and memory benchmark tests scores for the Axik system were in line with those of the other tested machines.

One outstanding feature of this unit is Promise Technology's DC-2031 IDE caching controller card, with its DriveCache subsystem. The DC-2031A is a newer model with even better performance than the DC-2030. It has a 4MB cache (expandable to 16MB); here it drives a 16-ms. Seagate ST2383A hard disk with a 32K cache buffer. This combination of features was beaten only by the cached and coprocessed disk subsystem of the BOSS CEO.

Ace Cache 486/WB/50, $4,499

The video subsystem has a 14-inch Sony CPD 1304 Multiscan HG Super VGA monitor that has a 75-Hz refresh rate at 1,024-by-768 noninterlaced resolution. It was paired with a 1MB Orchid Fahrenheit 1280° video adapter that can display noninterlaced resolutions of 800-by-600 at 72 Hz and 1,024-by-768 at 60 Hz. The Fahrenheit card's S3 GUI accelerator improves Windows graphics performance rather than DOS text display. The Ace was below average on our video test but placed second on the WINBENCH test.

Axik offers a 13-month warranty on parts and labor, under which you can return the unit to the company for repairs. Toll-free technical support is available weekdays from 8:00 to 6:30 P.S.T.; although the technical support is free, Axik does not give out its number until you purchase a system. Considering the well-detailed manual and troubleshooting guides, however, you may seldom have a need to call.

BOSS TECHNOLOGY CORP.
BOSS CEO
by Bruce Brown

While the EISA-based BOSS CEO outperforms the rest of the field in disk performance, its memory score is so low that one wonders whether the upgradable motherboard can handle a 50-MHz processor speed. Its drive capacity and memory expansion are both high, but our test system's $8,995 price may be considered steep even if discounted 20 or 30 percent by dealers.

The BOSS uses many AMI components, including AMI's show-stopping Fast Disk SCSI-2 host adapter paired with a Seagate 424MB 14-millisecond hard disk. The hard disk controller has 4MB of RAM, but its blazing speed comes from a dedicated 16-MHz 386SX processor. An upgradable card on the AMI motherboard holds the CPU, an AMI ROM BIOS, Intel support chips, and 128K of 15-ns. RAM cache. Eight SIMM sockets can hold a maximum of 128MB RAM. Although the I/O circuitry is integrated onto the motherboard, three of the system's eight slots are still required to hold the CPU card, video card, and disk controller.

The tower case measures 24.5 by 7.3 by 17 inches and has eight drive bays, six

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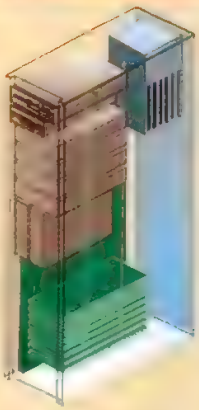

Ace Cache 486/WB/50
Axik Computer Inc., 1031F E. Duane Ave., Sunnyvale, CA 94086, 800-234-2945, 408-735-1234; fax, 408-735-1437.
List price (tested configuration): $4,499.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Seagate 16-ms. 340MB IDE hard disk, Promise Technology controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, Sony 14-inch monitor, 75-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 490 ON READER SERVICE CARD

PC LABS' BENCHMARK RELEASE 6.0
Ace Cache 486/WB/50

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	526	438	532	514
Memory	8,325	4,283	9,903	8,017
Disk	699	81	1,976	352
Video	1,561	1,360	4,417	2,605
WINBENCH	11,827	1,985	12,428	6,087

In Short: A Promise Technology DC-2031 IDE caching disk controller brought the $4,499 ISA-based Ace Cache 486/WB/50, from Axik, to second place on our disk benchmark test. Its processor and memory scores were also above average, but the S3 graphics accelerator linked good WINBENCH graphics performance to a low video score.

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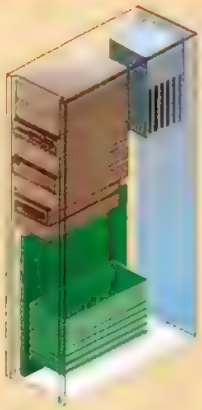


BOSS CEO
BOSS Technology Corp., 2546 NE Expwy., Atlanta, GA 30345, 800-628-1787, 404-636-2126; fax, 404-321-1499.
List price (tested configuration): $8,995
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 128K cache.
Disk drives and controller: Seagate 14-ms. 424MB SCSI-2 hard disk, AMI controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Cardinal 1,024-by-768 adapter with 1MB RAM, OPTiQuest 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 491 ON READER SERVICE CARD

BOSS CEO, $8,995

for drives that can use removable media. The video subsystem consists of a Cardinal High Color Super VGA video adapter, which has a Tseng chip and a Sierra Hi-Color RAMDAC paired with a 14-inch Optiquest 1000D monitor; the monitor has a 72-Hz vertical refresh rate at its maximum 1,024-by-768 noninterlaced resolution.

The BOSS's processor time is among the top three; its memory score, however, was substantially lower than that of any other machine in this review. Because of the dedicated 386SX/16 processor on the hard disk controller card, the disk turned in nearly three times the throughput of the next-fastest system. The Tseng chip–based Cardinal video adapter achieved an above-average score on our video test, but the system came in dead last on the WINBENCH test.

The BOSS is not *NetWare*-certified, but the company sells a variety of network options that include drive arrays, network operating systems, and various network cards, among them an EISA Ethernet adapter.

Sold only by dealers and VARs, the BOSS CEO comes with a two-year parts-and-labor warranty on the entire system and one year of on-site service from TRW. A second year of on-site service costs $149. Toll-free technical support is available weekdays from 8:00 to 7:00 E.S.T. The documentation comes in two 5- by 8-inch binders; it consists of original material describing the overall system and separate component manuals.

PC LABS' BENCHMARK RELEASE 6.0

BOSS CEO

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	531	438	532	514
Memory	4,283	4,283	9,903	8,017
Disk	1,976	81	1,976	352
Video	3,015	1,360	4,417	2,605
WINBENCH	1,985	1,985	12,428	6,087

In Short: A dedicated 386SX/16 on its drive controller gives the BOSS CEO astounding disk throughput, and its $8,995 price includes a SCSI-2 interface. But a low memory score offsets high CPU performance. Configured as an EISA file server, it came without a GUI accelerator; its video performance was slightly above average.

C² MICRO SYSTEMS INC.
C² Saber/50

by Margaret A. Piemonte

The C² Saber/50 is a spacious ISA-bus unit that fits eight drive bays into a case slightly shorter than the standard tower. Our test unit, with 8MB of RAM, a 256K cache, and a 340MB hard disk, was priced at $5,295. At 21.5 by 8 by 16 inches, it is shorter than the other towers reviewed here but still has good capacity: four front-accessible drive bays and four half-height internal ones. A 1.2MB and a 1.44MB floppy disk drive filled two of the front bays; the hard disk was internal. The 250-watt power supply, however, has only four connectors, so you will need Y splitters if you want to use more.

The motherboard, made by Empact Research and containing a Symphony chip set, seemed smaller than usual but can hold 64MB RAM in its 16 SIMM sockets. Our unit used eight 1MB 80-nanosecond SIMMs. The system's 256K, direct-mapped, write-through processor RAM cache can be upgraded to 1MB for an additional $75.

The Saber/50's motherboard has seven full-length 16-bit slots and one 8-bit slot. Our test unit held video, disk controller, and multifunction I/O cards, leaving four slots empty. The I/O card included an additional serial/game port connector, which requires an additional slot if you use it. The combination of Promise Technology's DC-2030 caching disk controller, which held 4MB of RAM, and the 15-millisecond Maxtor hard disk turned in a disk score that placed in the middle of the group. (A similar Maxtor/Promise combination, found in the ATronics ATI 486B/50, turned in slightly higher numbers.)

PC LABS' BENCHMARK RELEASE 6.0

C² Saber/50

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	509	438	532	514
Memory	7,855	4,283	9,903	8,017
Disk	311	81	1,976	352
Video	1,360	1,360	4,417	2,605
WINBENCH	11,256	1,985	12,428	6,087

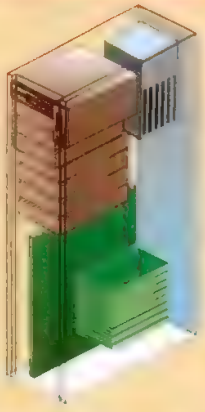
In Short: Slightly smaller than the average tower, the $5,295 ISA-bus C² Saber/50 has eight drive bays. Its memory and disk scores were below average, and its processor score came in slightly below the average. An S3 GUI accelerator made it typically fast on the WINBENCH graphics test but slow on the video test.

The Saber 50's video card, a Pixel Engineering V234T, had an S3 P86C911 GUI accelerator and 1MB of video RAM. C² Micro Systems shipped the unit with a 16-inch Nanao FlexScan 9080i monitor capable of 1,280-by-1,024 noninterlaced resolution with a 72-Hz refresh rate.

The Saber/50's processor and memory test scores were about average among a very tightly clustered group of scores. Unlike some faster systems, however, this machine uses 80-ns. DRAM and a write-through cache controller. Machines that ranked in the top grouping tended to have faster write-back caches.

The Saber/50's above-average result

PC MAGAZINE FACT FILE



C² Saber/50
C² Micro Systems Inc., 47560 Seabridge Dr., Fremont, CA 94538; 800-659-9997, 510-683-8888; fax, 510-683-8662
List price (tested configuration): $5,295.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms. 340MB IDE hard disk, Promise Technology controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Pixel Engineering 1,024-by-768 adapter with 1MB RAM, Nanao 16-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 492 ON READER SERVICE CARD

All the benefits of a laser printer

DESKTOP CONVENIENCE
RELIABILITY
LOW COST
SHARP, HIGH QUALITY OUTPUT
FAST PRINTING SPEED
PLAIN PAPER

A size

C size

On a much larger scale.

$1499

At last. A personal output device that combines the best features of a desktop laser printer with the ability to produce large format drawings. It's called ProTracer — a 360 dpi desktop printer/plotter that produces A, B, as well as C-size output.

ProTracer's speed and quiet operation come from the latest Canon inkjet technology and an Intel i960 processor. Drawings that take up to half an hour to print on a pen plotter take only five minutes on ProTracer!

And, unlike other large format devices, ProTracer isn't limited to plotting. Start with the ProTracer base unit that incorporates resident IBM ProPrinter and Epson LQ-1050 emulations, as well as an ADI plotter driver for AutoCAD users. Then, depending on your needs, choose from a variety of optional accessories including HP-GL® and PostScript® language emulation cards.

Optional Printer Accessories

HP-GL emulation card	$399
PostScript language emulation card	$499
2 MB memory upgrade	$299
4 MB memory upgrade	$499
8 MB memory upgrade	$899
Sheet feeder I (100 sheet)	$149
Sheet feeder II * (100 sheet)	$129
PacificTalk (AppleTalk interface module)	$199

*Sheet feeder I is required for use

At Pacific Data Products, we're devoted to customer service. We offer a 60-day money back guarantee of satisfaction, one year and optional extended warranties, and free lifetime technical support. Should you require a replacement unit while under warranty, one will be rushed to you immediately to minimize your downtime.

If you'd like to expand your printing and plotting capabilities, call Pacific Data Products at (619) 597-3200 ext. 2110, Fax (619) 552-0889.

PACIFIC DATA PRODUCTS

Pacific Data Products, Inc., 9125 Rehco Road, San Diego, CA 92121 ProTracer is a trademark of Pacific Data Products, Inc. PostScript is a registered trademark of Adobe Systems, Inc. Canon is a registered trademark of Canon, Inc. All other trade names referenced are the trademarks or registered trademarks of the respective manufacturer. Nozzle image courtesy of AutoDesk Inc Tiger rendering, artist unknown; picture part of public domain ProTracer uses the latest in high technology innovation including PeerlessPage™ the advanced Imaging Operating System from Peerless EUROPEAN OFFICES: Geneva Tel (41) 22 41 26 50, Fax (41) 22 41 06 82, France Tel (33) 1 39 23 20 00, Fax (33) 1 39 63 31 20, U.K Tel (44) 442 231414, Fax (44) 442 23 65 40 © 1992 Pacific Data Products, Inc

Windows is now new manageme

XSoft
A Xerox Division

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XEROX

under
nt.

Sure Windows is great. Except that you spend more time managing your desktop than actually working on it. Until now, that is. Because XSoft's new Rooms for Windows software has made working in Windows much more manageable.

Rooms is an enhancement to your existing Windows software. It's also a considerable enhancement to your productivity.

Think about what happens now when you're running several applications. You have one desktop to work in, with all your files squeezed into the screen like sardines in a can.

With Rooms, you can set up an unlimited number of desktops, or Rooms. Each one with its own combination of applications and files, arranged on the screen however it makes the most sense to you.

In Windows, the more programs you use, the more opening, closing, reopening, and positioning of applications is required. Not so with Rooms. Simply by pointing and clicking, you can move from Room to Room instantly. Even if the Room you're moving to contains a completely different set of applications and files.

You can even set up Rooms for DOS applications. Moving from a Windows Room to a DOS Room is an easy point and click operation. And getting back to a Windows Room takes but a keystroke.

As if that's not convenient enough, all your files and applications stored in all your Rooms can open automatically, every time you turn on your PC! Then when you enter a Room, everything's ready to go, and set up exactly as you last saved it.

So you see, Rooms is actually much more than a mere Windows enhancement. It's a management overhaul.

To purchase Rooms for Windows, visit your nearest dealer or call 1-800-626-6775. In Canada call 1-800-668-0199. In Quebec call 1-800-668-0133. Suggested retail price $99.

Xerox
The Document Company

Without Rooms around to manage things, Windows can be quite difficult to work with.

CIRCLE 179 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order by company name

List price (*PC Magazine* configuration) For this review of 50-MHz 486 computers, we requested a standard configuration that included 8MB of RAM, a 340MB hard disk, two floppy disk drives, a Super VGA color display subsystem, one parallel and two serial ports, DOS 5.0, and Microsoft Windows 3.0. All 19 PCs reviewed—except for the SVC 450DXC I2-510, which has a 510MB hard disk—provide a reasonably close match to this list of requirements.

Distribution channel Some machines are sold directly through mail order, others through dealers. Dealers have previously offered discounts of 25 percent or more off the list price; however, an industry-wide price restructuring has cut these discounts in many cases. *PC Magazine* views a 15 percent discount as typical.

The **chip set manufacturer** makes the logic that connects the CPU with the other functions managed by the system board.

System shadowing/Video shadowing Shadow RAM is a technology that loads system BIOS or video BIOS from slower ROM into faster RAM on boot-up. Shadowing uses RAM located between 640K and 1MB.

A **ZIF (zero-insertion-force) socket** has a lever that allows you to remove and replace the CPU easily.

The **BIOS version (or date)** can affect PC Magazine Labs' benchmark test results. A machine with a different BIOS may perform differently.

Flash memory contains BIOS code that can be updated via software. The BIOS is generally stored in conventional ROM, which has no provision for modification.

Installable RAM indicates the minimum and maximum amount of memory that can be installed using any combination of chips and proprietary cards.

The **cache controller** determines the amount of information that is taken from the processor or main memory and held in the cache.

Cache architecture A *four-way* set-associative cache, native to the 486's internal 8K cache, divides data into four equal blocks and is viewed as most effective. A *two-way* cache's data is split into two equal blocks, and the data in a *direct-mapped* cache (the most common and least costly) is not divided.

Cache write policy A *write-back* design can cache data read from and written to memory. This method is theoretically superior to that of a *write-through* cache, in which only reads from memory are cached.

Front-accessible drive bays can be reached from the system's front panel and can support removable media (such as tape and CD-ROMs); **internal drive bays** can be reached only by opening the case. We report the maximum number of accessible and internal drives the system can hold.

❑—Editors' Choice ■—Yes ❑—No	ACMA 486/50I	Amax 486/50 ISAmax Power Station	ATronics ATI 486B/50	Axik Ace Cache 486/WB/50	BOSS CEO	C³ Saber/50	Club Falcon 450T	Compaq Deskpro 486/50L	CUI Advantage 486-50CX
List price (*PC Magazine* configuration)	$4,995	$4,249	$4,230	$4,499	$8,995	$5,295	$3,399	$13,822	$4,995
Hard disk capacity	425MB	425MB	340MB	340MB	424MB	340MB	425MB	340MB	340MB
Distribution channel	Direct	Dealers	Dealers, direct	Direct	Dealers	Dealers	Dealers, direct	Dealers	Dealers
Case style	Tower	Desktop	Mini-tower	Tower	Tower	Tower	Tower	Desktop	Tower
Bus architecture	ISA	ISA	ISA	ISA	EISA	ISA	ISA	EISA	ISA
MOTHERBOARD									
Motherboard manufacturer	Helm Engineering	Helm Engineering	ATI	Axik	AMI	ERI	Club	Compaq	CUI
Chip set manufacturer	SIS	SIS	UMC	Contaq	Intel	Symphony	Club, VLSI	Compaq	Symphony
System shadowing/ Video shadowing	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
ZIF socket	❑	❑	❑	❑	❑	❑	❑	❑	❑
Upgradable processor	■	■	■	❑	■	■	■	❑	❑
BIOS version (or date)	AMI (May 1991)	AMI (May 1991)	AMI (July 1991)	AMI 1.0	AMI (July 1991)	AMI (May 1991)	AMI (March 1991)	Compaq	AMI (May 1991)
Flash memory	❑	❑	❑	❑	❑	❑	❑	❑	❑
Supports Weitek/ Cyrix coprocessor	■ / ❑	■ / ❑	■ / ❑	■ / ■	■ / ❑	■ / ■	■ / ■	❑ / ❑	■ / ❑
MEMORY AND PROCESSOR RAM CACHE									
Installable RAM	1MB–64MB	1MB–64MB	1MB–64MB	1MB–64MB	1MB–128MB	1MB–64MB	1MB–64MB	8MB–104MB	1MB–64MB
Cache controller	SIS	SIS	UMC	Contaq	AMI	Symphony	Club	Intel	Symphony
Installable RAM cache	64K–256K	64K–256K	64K–256K	64K–256K	128K	64K–1MB	64K–256K	256K	64K–256K
Cache architecture	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Two-way set-associative	Two-way set-associative
Cache write policy	Write-through	Write-through	Write-back	Write-back	Write-back	Write-through	Write-back	Write-back	Write-through

AIR—Advanced Integration Research, AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., ERI—EMPaC Research Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc.

The **minimal floppy disk drive configuration** indicates whether the vendor equips its base-priced system with a 1.2MB floppy disk drive, a 1.44MB floppy disk drive, or both.

Hard disk options We report the range of hard disk capacities the vendor offers.

Disk controller location A computer with IDE (integrated drive electronics) circuitry has its controller functions integrated into the drive and motherboard but may have a separate controller.

Expansion bus For each type of expansion slot—8-bit, 16-bit, 32-bit EISA, and 32-bit proprietary—we report the number of slots on the motherboard and the number of slots left open when the PC is equipped in our *PC Magazine* configuration. We also indicate whether the motherboard contains integrated parallel, serial, mouse, or Ethernet ports.

A **16550 UART** (Universal Asynchronous Receiver/Transmitter) aids high-speed modem transfers. The chip can replace an 8250 or 16450 UART, and some companies offer it as an inexpensive upgrade product.

The **tested display mode** refers to the resolution of the video card that came in the tested configuration. For this review, we requested a Super VGA display (800 by 600 pixels), though we accepted 1,024-by-768 as well.

The **display circuitry** can reside on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled there is no way to upgrade it.

The **video chip set manufacturer** makes the logic that runs the video adapter.

The **number of device connectors** indicates how many internal storage devices the power supply can support without requiring Y cables (power splitters).

DOS versions are listed here. The base-priced system includes DOS. (The *PC Magazine* configuration includes DOS 5.0—4.01 or 3.3 if 5.0 is not available—to allow more accurate price comparisons.)

Other bundled software refers to any programs bundled with the system, free of charge. This category includes disk-caching software (such as SMARTDRV.SYS), expanded-memory-management software (such as *QEMM-386*), Microsoft Windows 3.0, and any applications the vendor supplies as extras.

The **first-year on-site service charge** may be included in the price of the system, or it may be a set or variable amount.

FCC Class B identification number Systems with a Class B rating from the Federal Communications Commission have sufficiently low radio-frequency emissions to be used in the home. To verify any system's status, you may dial up the Public Access Link, the FCC's own bulletin board service, at 301-725-1072.

Dell PowerLine 450DE	DT 486-50	EPS 80486-50	Intelec INT 486-50	Mega Impact 486/50E	National Micro Systems Flash 486-50C	PCI 486-50C128	Poly 486-50VF	Silicon SVC 450DXC I2-510	SST 486-50MWC
$7,976	$3,499	$4,150	$3,799	$4,450	$3,064	$4,995	$4,500	$3,650	$3,850
345MB	360MB	340MB	340MB	340MB	340MB	340MB	340MB	510MB	340MB
Direct	Direct	Direct	Dealers, direct	Dealers, direct	Direct	Dealers, direct	Dealers, direct	Dealers	Dealers, direct
Small-footprint	Tower	Tower	Tower	Tower	Tower	Tower	Tower	Tower	Small-footprint
EISA	EISA	ISA	ISA	EISA	ISA	ISA	ISA	ISA	ISA
Dell	AIR	Contaq	Octek	AIR	AIR	Ideal	InterComp	Silicon Valley	TMC Research
Dell, Intel	Intel, SIS	Contaq	OPTi	Intel	C&T, UMC	Contaq	OPTi	OPTi	C&T, OPTi
■ / ■	❑ / ■	■ / ■	■ ■	■ / ■	■ ■	■ / ■	■ ■	■ / ■	■ / ■
❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
■	❑	❑	❑	❑	❑	❑	❑	❑	■
Phoenix 80486 Plus A06	Phoenix 1.01.04	AMI (July 1991)	AMI (July 1991)	AMI (April 1991)	AMI (May 1991)	AMI (May 1991)	AMI (September 1991)	SVC AT 4.01.dg	AMI (July 1991)
■	❑	❑	❑	❑	❑	❑	❑	❑	❑
❑ / ❑	■ / ❑	■ / ❑	■ ❑	■ / ❑	■ / ■	■ / ■	■ / ■	■ / ■	■ / ❑
4MB–96MB	1MB–64MB	1MB–32MB	4MB–64MB	1MB–64MB	1MB–64MB	1MB–32MB	1MB–32MB	1MB–64MB	1MB–64MB
Dell Asic	Discrete Logic	Contaq	OPTi	AIR	C&T	Contaq	OPTi	OPTi	OPTi
128K	64K–256K	128K–256K	64K–256K	64K–256K	64K–256K	64K–256K	256K–512K	64K–256K	64K–256K
Direct-mapped	Direct-mapped	Two-way set-associative	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
Write-through	Posted write-through	Write-back	Write-back	Write-through	Write-back	Write-back	Write-back	Write-back	Write-back

CONTINUES

WHAT GOOD IS POW

ER WITHOUT VISION?

Introducing the first 486SX notebook with TFT color.

You are about to witness an incredible display of power.

Introducing the Toshiba T4400SXC. The first notebook to offer you all the power of a 486SX with all of the jaw-dropping possibilities of TFT LCD active matrix color.

Consider that with its active matrix Super VGA color screen, the T4400SXC can actually display a kaleidoscope of 256 simultaneous colors at a 640 x 480 pixel resolution.

Remarkably, these 256 colors can be drawn from a palette of 185,000 colors to give life to photographic images and color intensive presentations. It's enough to make your retina want to take a vacation.

Not to mention that each pixel on the screen is controlled by three individual transistors, ensuring perfect focus and color registration. The result is amazing clarity far superior to desktop monitors and a brighter, faster screen that far exceeds passive matrix LCD color screens.

Combined with a blazing 25MHz, 486SX microprocessor and 8K internal cache, it's powerful enough to handle your wildest visions.

Of course, you shouldn't be limited by the number of ideas you have either. Which is why the T4400SXC is equipped with a 120MB hard drive for plenty of storage. And 4MB of RAM expandable to 20MB.

And since ideas happen anywhere, any time, we've designed it to fit in half of a briefcase and given it a Nickel Cadmium battery that lasts 3 hours per charge.

Of course, there are times like payday when it is necessary for you to be in the office. Which is why we made our new notebook to be expandable with our Deskstation IV, giving you two expansion slots, and ports for external monitor and external keyboard.

intel inside

Naturally, this is all just the tip of the iceberg, so call us at 1-800-457-7777 for more information.

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CIRCLE 379 ON READER SERVICE CARD

C² Saber/50, $5,295

on our WINBENCH test and bottom-rung result on our video test is characteristic of the S3 GUI accelerator, which is optimized for the Windows environment.

The company includes on-site service for the C² Saber/50 through Nationwide in its standard one-year warranty on parts and labor. A toll-free number connects you with Nationwide weekdays from 8:00 to 6:00 P.S.T.; the response/repair time from one of its 280 locations is generally within 48 hours. Technical support from C² Micro Systems is not toll-free and is available at 510-651-6432 weekdays from 8:00 to 6:00.

CLUB AMERICAN TECHNOLOGIES INC.

Club Falcon 450T

by Robert Anthony

While the Club Falcon 450T, from Club American Technologies, was among the lowest-priced units in this group, it also

SUMMARY OF FEATURES

Products listed in alphabetical order by company name

❑—Editors' Choice ■—Yes ❑—No	ACMA 486/50i	Amax 486/50 ISAmax Power Station	ATronics ATI 486B/50	Axik Ace Cache 486/WB/50	BOSS CEO	C² Saber/50	Club Falcon 450T	Compaq Deskpro 486/50L	CUI Advantage 486-50CX
DISK DRIVES									
Front-accessible drive bays	Four 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Two 5.25 inch, two 3.5-inch	Six 5.25-inch, no 3.5-inch	Four 5.25-inch, two 3.5-inch	Four 5.25-inch, no 3.5-inch	Five 5.25-inch, no 3.5-inch	Three 5.25-inch, no 3.5-inch	Six 5.25-inch, no 3.5-inch
Internal drive bays	4	2	1	3	2	4	4	4	4
Minimal floppy disk drive configuration	1.2MB, 1.44MB	1.2MB or 1.44MB	1.2MB or 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB or 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
2.88MB floppy disk drive available	■	■	❑	❑	❑	■	❑	❑	❑
Hard disk options	52MB–1.2GB	52MB–1.2GB	40MB–1.2GB	40MB–1.2GB	40MB–1.7GB	52MB–1.2GB	52MB–1.2GB	120MB–510MB	52MB–1.2GB
Disk controller location	Card	Card	Card	Card	Card	Card	Card	Motherboard	Card
EXPANSION BUS									
8-bit slots	None	None	1	None	None	1 (open)	None	None	None
16-bit slots	7 (4 open)	7 (4 open)	6 (4 open)	8 (5 open)	None	7 (3 open)	7 (5 open)	None	8 (5 open)
32-bit EISA slots	None	None	None	None	7 (5 open)	None	None	8 (7 open)	None
32-bit proprietary slots	1(none open)	1(none open)	1(none open)	1(open)	1(open)	None	1(none open)	2 (none open)	None
Parallel, serial, mouse ports on motherboard	None	None	None	None	1, 2, 0	None	None	1, 2, 1	None
Ethernet port on motherboard	None	None	None	None	None	None	None	None	None
16550 UART	Optional	None	Standard	Optional	Standard	Optional	Optional	None	Standard
VIDEO									
Tested display mode	Super VGA	Super VGA	Super VGA	Super VGA	Super VGA	Super VGA	Super VGA	Super VGA	Super VGA
Display circuitry location	Card	Card	Card	Card	Card	Card	Card	Card	Card
Video chip set manufacturer	ATI	S3	Trident	S3	Tseng	S3	Tseng	Compaq	Tseng
POWER SUPPLY									
Power supply (watts)	250	250	200	300	300	250	250	300	280
Number of device connectors	5	5	5	6	4	4	6	7	5
SOFTWARE									
DOS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	Compaq DOS 5.0	5.0
Other bundled software	*Glossary*, Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	*CEMM*, Compaq disk cache utility	Microsoft Windows 3.0, *PFS Window Works*
MISCELLANEOUS									
Warranty	1 year	1 year	1 year	None	2 years	1 year	1 year	1 year	1 year
First year on-site service charge	Included	$69	$99	N/A	N/A	Included	$49	N/A	Included
FCC Class B identification number	None	None	None	None	None	JDN486ECA	None	None	None

N/A—Not applicable: The product does not have this feature.

AIR—Advanced Integration Research, AMI—American Megatrends Inc., C&T—Chips and Technologies Inc., ERI—EMPaC Research Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc.

scored low on our memory, processor, and WINBENCH benchmark tests. The Falcon 450T redeemed itself somewhat with a strong showing on our video and disk tests, but on the whole, the package did not distinguish itself from the crowd.

For $3,399, the Falcon 450T came with 8MB of 60-nanosecond RAM, a 425MB Quantum ProDrive 425A IDE hard disk with a 256K cache, high-density 1.2MB and 1.44MB floppy disk drives, a Club 500B Super VGA monitor (with a 1,024-by-768 noninterlaced maximum resolution), and Diamond Technologies' 1,024-by-768 Super VGA video adapter with 1MB of RAM.

Five of the unit's seven ISA 16-bit slots remained open after the standard video and floppy/hard disk controller cards were installed, while a proprietary 32-bit slot was occupied by a card housing the computer's processor. Club American sells both 386 and 486 CPU cards for use on the Falcon 450T's upgradable motherboard.

Inside the 25.5- by 8.5- by 20.5-inch

Club Falcon 450T, $3,399

Dell PowerLine	DT 486-50	EPS 50486-50	Intelec INT 486-50	Mega Impact 486/50E	National Micro Systems Flash 486-50C	PCI 486-50C128	Poly 486-50VF	Silicon SVC 450DXC i2-510	SST 486-50MWC
Three 5.25-inch, no 3.5-inch	Four 5.25-inch, two 3.5-inch	Four 5.25-inch, two 3.5-inch	Four 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch	Five 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch	Four 5.25-inch, no 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch
2	4	2	2	4	5	4	4	1	None
1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
❑	❑	■	❑	■	❑	■	■	■	❑
230MB–500MB Motherboard	80MB–3GB Card	80MB–1.2GB Card	52MB–1.2GB Card	120MB–1GB Card	40MB–1.7GB Card	20MB–1.2GB Card	200MB–2.5GB Card	40MB–510MB Card	40MB–1.2GB Card
None	None	2 (1 open)	1 (open)	None	None	1 (open)	None	None	1 (open)
None	None	6 (4 open)	6 (3 open)	None	7 (4 open)	6 (4 open)	8 (5 open)	8 (6 open)	6 (4 open)
6 (5 open)	8 (6 open)	None	None	8 (6 open)	None	None	None	None	None
1 (open)	None	None	1 (open)	None	1 (open)	None	None	1 (open)	1 (open)
1, 2, 1	1, 2, 0	None	None	1, 2, 0	None	None	1, 2, 1	1, 2, 0	None
None	None	None	None	None	None	None	None	None	None
None	Standard	Optional	Optional	Optional	None	Optional	Optional	N/A	Optional
Super VGA Motherboard	Super VGA Card	Super VGA Card	Super VGA Card	Super VGA Card	Super VGA Card	Super VGA Card	1,024 x 768 Card	Super VGA Card	Super VGA Card
Tseng	Tseng	S3	Tseng	S3	Tseng	Contaq	S3	Trident	S3
224	300	300	250	250	275	250	250	230	200
4	7	6	4	6	5	4	6	5	5
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	Actix graphics drivers, AMI ROM BIOS setup utility, BusTek SCSI driver	Microsoft Windows 3.0	Microsoft Windows 3.0	Microsoft Windows 3.0	*QATest*, Version 4.21	*Cache86* Microsoft Windows 3.0, *PreCursor*, *Tree86*
1 year Included	15–24 months $50	1 year Included	1 year $49	1 year N/A	15–24 months $75	2 years Included	2–5 years $75	1 year $300	1 year Included
E2K450DE	None	None	None	None	None	None	None	None	None

ENDS

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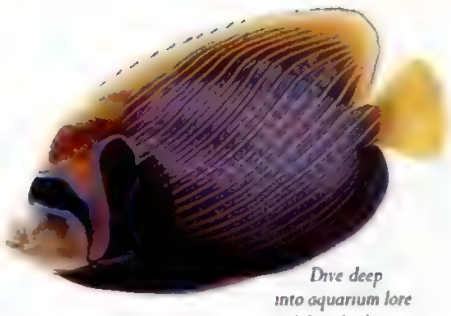

Dive deep into aquarium lore. Like whether a canister or protein filter is better for a 110-gallon saltwater tank.

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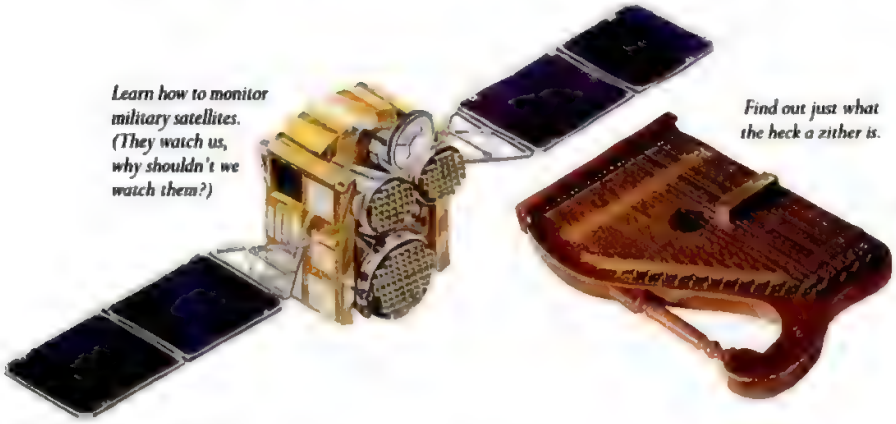
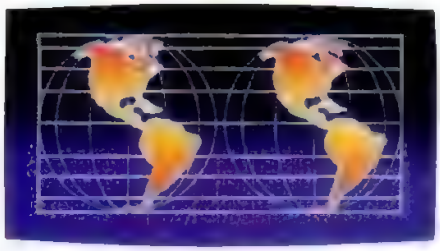
Finally, a computer information service you can't outgrow. No matter how hard you try.



Learn how to monitor military satellites. (They watch us, why shouldn't we watch them?)

Find out just what the heck a zither is.



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CIRCLE 226 ON READER SERVICE CARD

PC LABS' BENCHMARK RELEASE 6.0

Club Falcon 450T

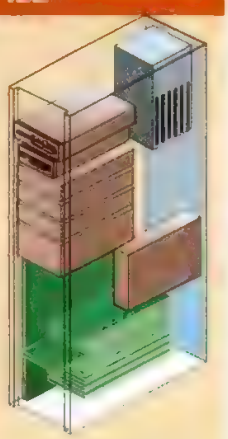
Test Scores		Systems in this review Worst	Best	Average
Processor	438	438	532	514
Memory	6,106	4,283	9,903	8,017
Disk	641	81	1,976	352
Video	4,149	1,360	4,417	2,605
WINBENCH	2,352	1,985	12,428	6,087

In Short: Although the $3,399 ISA-based Club Falcon 450T made a strong showing on our disk and video tests, its processor, memory, and WINBENCH scores were below average for our group. Its low price may tempt those with limited budgets, nonetheless.

tower-style case was a vast amount of vacant space, providing ample room for large hands and small tools. Three of the five half-height 5.25-inch external drive bays were open, as was half of a full-height 5.25-inch internal drive bay.

The memory benchmark test placed the Falcon 450T well off the pace, and the unit came in last on the processor test. The low marks could be due to the type of RAM cache used. The 64K direct-mapped, write-through external processor RAM cache could not match the other processor/cache combinations used by most of the other tested machines. A 256K SRAM cache, which would match the size provided by most of the other machines we tested, costs $220 but would still keep the Falcon 450T among the least expensive machines of its type.

FACT FILE



Club Falcon 450T
Club American Technologies Inc., 3401 W. Warren Ave., Fremont, CA 94539; 800-524-2582, 510-683-6571; fax, 510-490-2687.
List price (tested configuration): $3,399.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 64K cache.
Disk drives and controller: Quantum 14-ms. 425MB IDE hard disk, Promise Technology controller, 2MB cache, 1.2MB or 1.44MB floppy disk drive.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Club American 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 493 ON READER SERVICE CARD

HIGH VIDEO AND DISK SCORES

The Falcon 450T ranked near the top on the video and disk tests. The 14-millisecond-rated Quantum 425MB hard disk and Promise Technology DC-2032 controller with 2MB disk cache RAM excelled. The Diamond SpeedSTAR Super VGA video board also performed well when compared with other boards that did not use accelerators for graphical environments. On our WINBENCH test, the Falcon 450T again was near the bottom of the rankings. This performance is typical of Tseng chip–based video cards.

The Club Falcon 450T has a one-year warranty and on-site service for $49 for the first year. While technical support is free, the phone call is not. It is available weekdays from 7:00 to 6:00 P.S.T.

COMPAQ COMPUTER CORP.

Compaq Deskpro 486/50L

by Mario Baldasserini

Compaq's EISA-based Deskpro 486/50L meets the company's high standards for rugged construction and excellent design but comes at a substantial price. Our test unit cost $13,822, and Compaq added a tape backup unit that brought the price to $14,721.

Compaq put its own motherboard and BIOS in this desktop model but shops among the major manufacturers for the chip sets. The company's motherboard has no RAM itself. Instead, all the RAM is located on a 32-bit expansion card that holds a combination of soldered RAM and SIMM sockets and plugs into a dedicated motherboard slot. Our unit had 8MB of 80-nanosecond DRAM soldered to the expansion card; you can expand that amount to 104MB. Intel's 82495DX-50 write-back caching controller uses the MESI (modified, exclusive, shared, and invalid data) protocol for cache consistency to govern the 256K of two-way, set-associative cache.

The motherboard has nine 32-bit EISA slots. Of these, two are dedicated—one for memory expansion and one for the video adapter—leaving seven free.

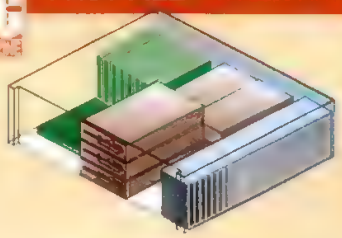
Compaq Deskpro 486/50L, $13,822

The motherboard design integrates one parallel port, two 9-pin serial ports, one mouse port, and the IDE interface connector. Expansion capabilities in this desktop unit consist of three accessible 5.25-inch half-height bays and four internal 3.5-inch bays.

The IDE hard disk subsystem uses a 340MB Compaq/Conner CP-3301 hard disk with a rated access time of 12 milliseconds, but it contains no hardware cache. Competing in the whole group, the Deskpro 486/50L turned in middle-of-the-pack disk results but placed second against systems without caching disk controllers.

Compaq labels appear on the video board and the monitor. The former, with Compaq's graphics accelerator chip, displays 800-by-600 noninterlaced resolution; Compaq provided only 512K of video RAM on this card, though. The remaining

FACT FILE



Compaq Deskpro 486/50L
Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; 800-231-0900.
List price (tested configuration): $13,822.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 256K cache.
Disk drives and controller: Conner 12-ms. 340MB IDE hard disk, 64K buffer, 1.2MB and 1.44MB floppy disk drives.
Display: Compaq 640-by-480 adapter with 512K RAM, Compaq 14-inch monitor, 60-Hz refresh rate.
Software: Compaq DOS 5.0, *CEMM*, Compaq disk cache utility.

CIRCLE 494 ON READER SERVICE CARD

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PC LABS' BENCHMARK RELEASE 6.0

Compaq Deskpro 486/50L

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	529	438	532	514
Memory	9,903	4,283	9,903	8,017
Disk	145	81	1,976	352
Video	3,588	1,360	4,417	2,605
WINBENCH	5,183	1,985	12,428	6,087

In Short: An 8MB memory adapter that can process 64 bits of interleaved RAM per cycle put the Compaq Deskpro 486/50L first on our memory test. This $13,822 EISA-based desktop did well on our processor and video tests, but its disk score was typical of noncached systems. The non-GUI graphics meant an average WINBENCH score.

18 vendors placed 1MB on their video adapters. In addition, the 14-inch monitor's highest noninterlaced resolution was 640-by-480 at a 60-Hz refresh rate. Compaq's new line of high-resolution monitors, the QVision line, was not yet shipping at the time we tested this system.

The Compaq Deskpro 486/50L's warranty covers parts and labor for one year. TRW, GE Computer Service, or Intelogic Trace furnish on-site service at a price set by the dealer; dealers also set shipping charges to and from the destination and the estimated time it will take to repair a machine. You can reach technical support on an 800 number weekdays from 7:00 to 7:00 C.S.T.

CUI

CUI Advantage 486-50CX

by William P. Flanagan

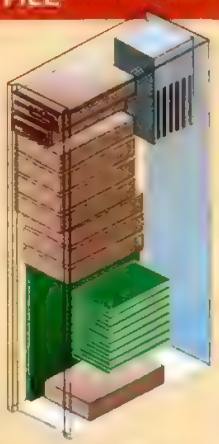
The CUI Advantage 486-50CX is a roomy ISA tower, but its motherboard design is somewhat limiting. On our tests, the system turned in average or below-average scores on all but our video test.

Priced at $4,995, the CUI came to PC Magazine Labs with 8MB of RAM, a 64K processor RAM cache, and a cached 340MB hard disk. The system's tower case has ten half-height 5.25-inch drive bays—six in front, four internal—and a 280-watt power supply. The relatively small motherboard, made by CUI and holding an AMI BIOS and Symphony chip set, has only four SIMM sockets but can accept 16MB SIMMs, so the maximum RAM expansion is 64MB. The board does have one notable shortcoming, however: Two of the eight 16-bit ISA slots are partially blocked by a fan. The company offsets this problem by offering to replace the fan with a flat heat-sink cover for the CPU, at no extra cost.

CUI Advantage 486-50CX, $4,995

The CUI Advantage 486-50CX's disk subsystem included a 340MB Maxtor hard disk rated at 13 milliseconds and an UltraStor controller with a 4MB cache. A CUI-labeled HiColor Turbo F/X video adapter, containing a Tseng chip set, had 1MB of RAM and displays 1,024-by-768 resolution at 72 Hz. This card was paired with a Sony CPD 1304 Multiscan HG monitor that displays 1,024-by-768 noninterlaced resolution at a vertical refresh rate that can be set from 50 to 87 Hz.

FACT FILE



CUI Advantage 486-50CX
CUI, 1680 Civic Center Dr., #101, Santa Clara, CA 95050; 800-458-6686, 408-241-9170; fax, 408-241-2487.
List price (tested configuration): $4,995.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 64K cache.
Disk drives and controller: Maxtor 13-ms. 340MB IDE hard disk, UltraStor controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: CUI 1,024-by-768 adapter with 1MB RAM, Sony 13-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0, *PFS:WindowWorks*.

CIRCLE 495 ON READER SERVICE CARD

PC LABS' BENCHMARK RELEASE 6.0

CUI Advantage 486-50CX

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	441	438	532	514
Memory	7,888	4,283	9,903	8,017
Disk	348	81	1,976	352
Video	3,240	1,360	4,417	2,605
WINBENCH	2,541	1,985	12,428	6,087

In Short: An ISA tower with ten drive bays, the $4,995 CUI Advantage 486-50CX turned in an average score on the disk test. A 64K cache and 80-ns. RAM may account for its lower processor and memory scores. Graphics performance was comparable with that of other non-GUI systems: high on the video test and low on the WINBENCH test.

The CUI Advantage 486-50CX's processor performance fell short, though its memory performance was only slightly below average. The 64K two-way set-associative write-through processor RAM cache was slower at handling records larger than 64K on our processor test, and this likely caused the drop-off. An upgrade to a 256K cache costs $80. In terms of video performance, the CUI's scores were characteristic of other systems without GUI accelerators: above average on the video test and below average on the WINBENCH test. Its disk performance was about average.

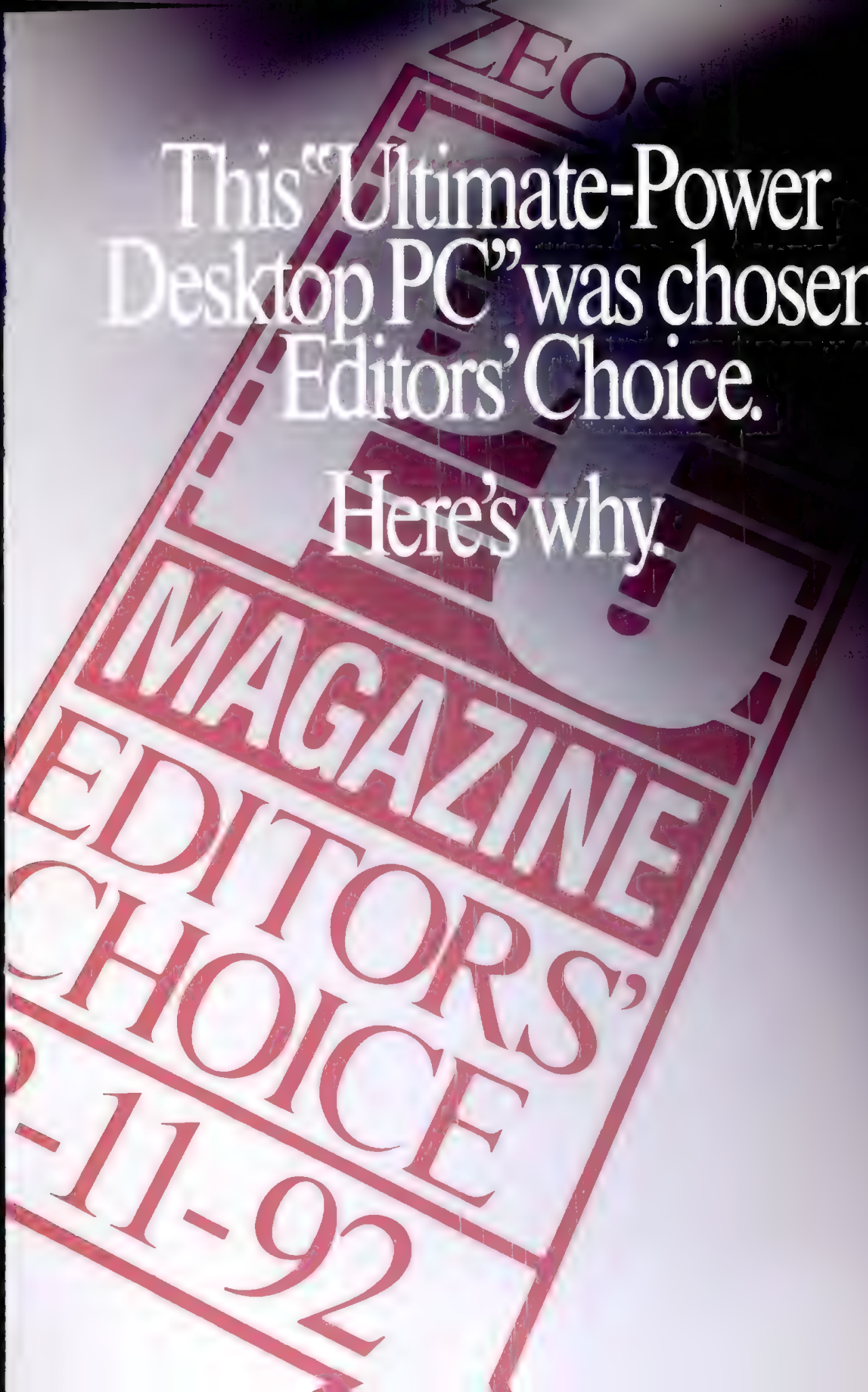
FAIR DOCUMENTATION

The documentation was not written specifically for the unit's motherboard but still explains its basics; a manual covering this machine specifically was promised but was not available at the time we tested the unit. Also included was a manual on the Pro-Excellent 121 keyboard, which combines a serial cable connector with the keyboard cable. This allows users to plug different types of serial-port devices (a mouse, trackball, or scanner) to the front of the computer case instead of the back. The Pro-Excellent 121 also has eight cursor keys, some of which move the cursor in a circular direction, such as up one line and over one space.

A one-year parts-and-labor warranty includes free on-site service from U.S. Net, a company with more than 750 locations in the U.S., Europe, and Australia. Toll-free technical support for the CUI Advantage 486-50CX is available weekdays from 8:00 to 5:00 P.S.T.

This "Ultimate-Power Desktop PC" was chosen Editors' Choice.

Here's why.



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Because right here, right now, ZEOS gives you the option of '486 50MHz power! We're talking power unlike anything you've seen before. Take either the ZEOS 486DX2-50 or the 486DX-50. Absolutely unbelievable *performance!* And the price? That's what you really won't believe; only a couple hundred dollars more than the ZEOS 486-33. *Amazing.*

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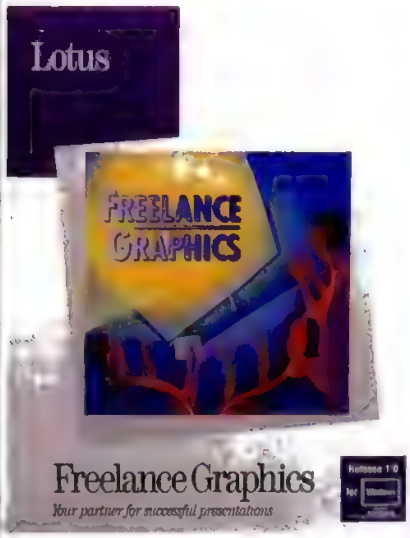

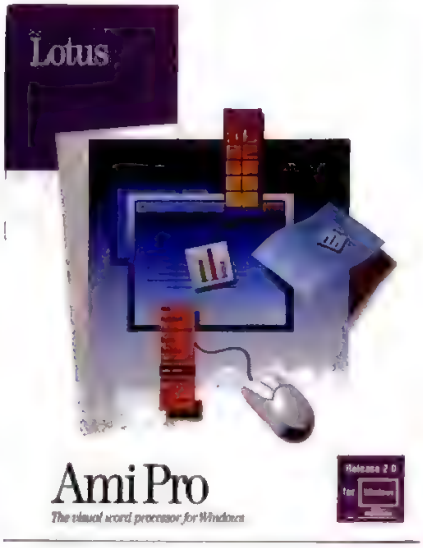

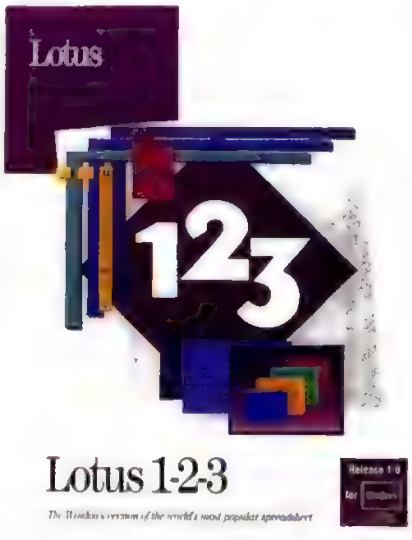

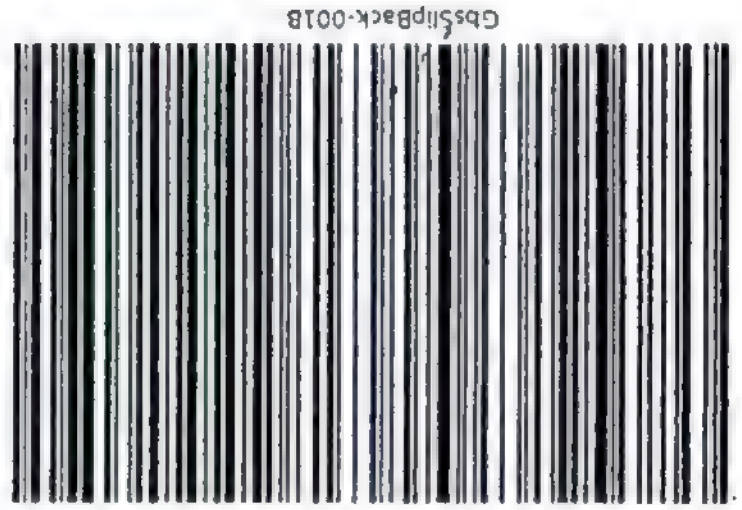

Back

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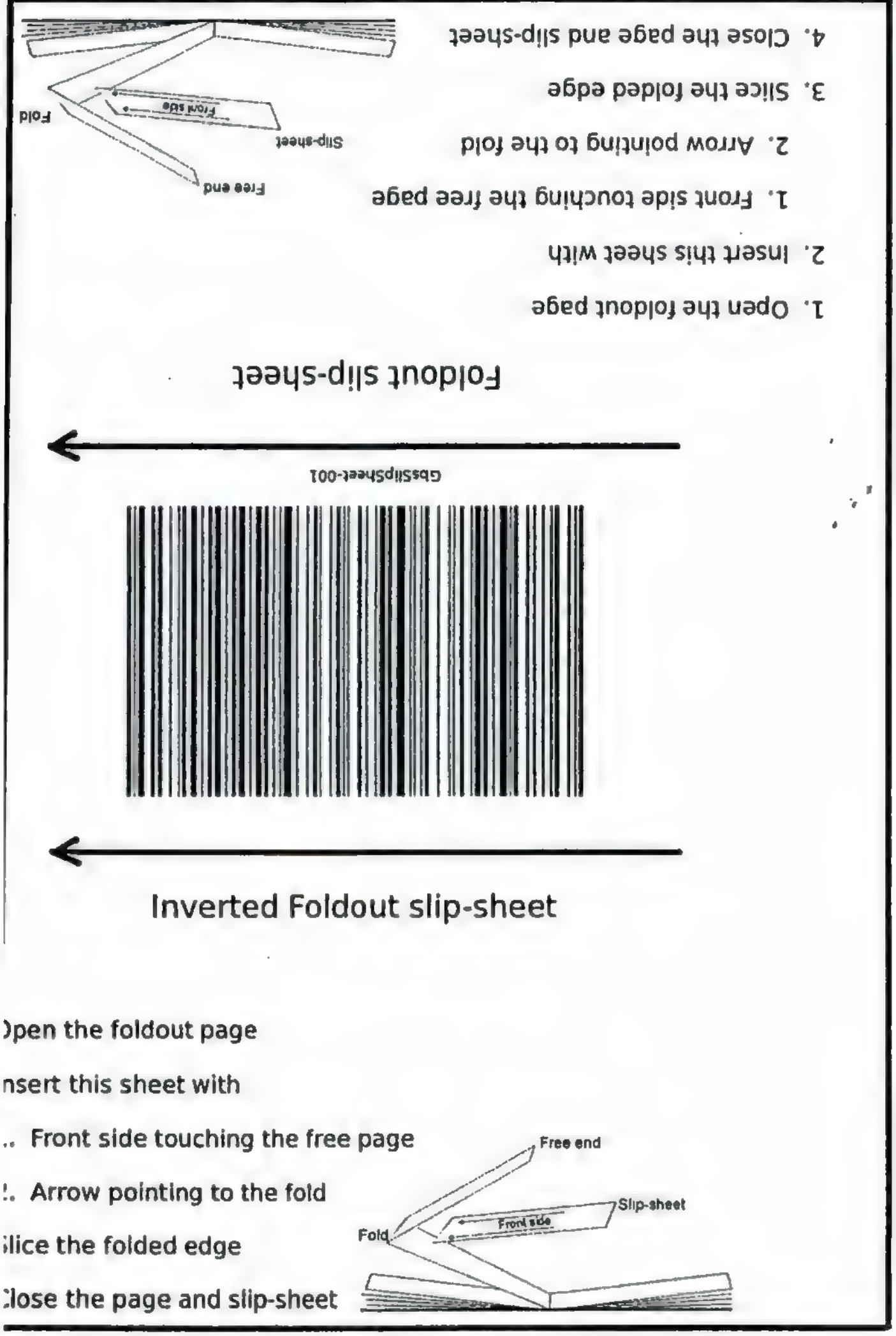
Inverted Back

1. Follow instructions on the other side


Inverted Foldout slip-sheet
GbsSlipSheet-001
Foldout slip-sheet
1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet
Free end
Slip-sheet
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!. Arrow pointing to the fold
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:lose the page and slip-sheet
Free end
Slip-sheet
Front side
Fold

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You have probably heard about the importance of protecting your new computer investment with a surge suppressor. Well, your new ZEOS upgradable desktop system already has one. *Built into the power supply!* That's innovation, built in from ZEOS.

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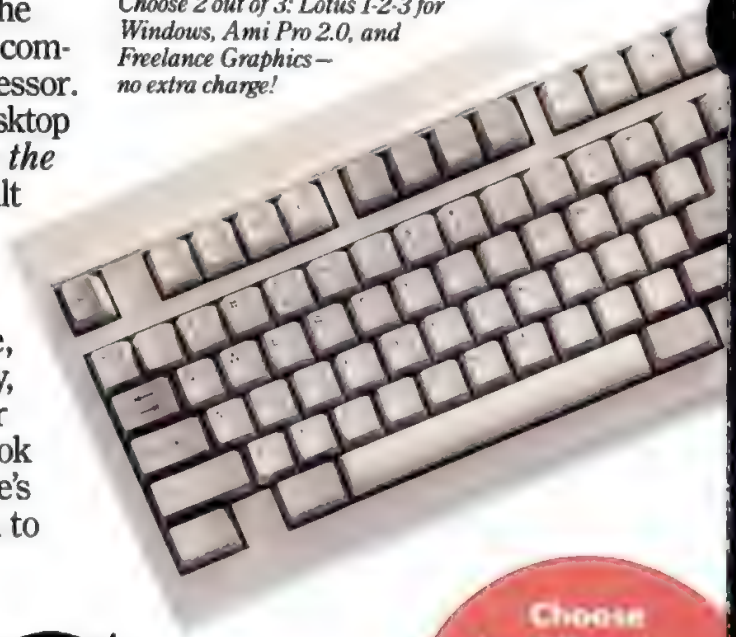

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And all of this is just for starters. Because when you turn the page we're going to talk about a lot of other very exciting and important reasons for you to buy from ZEOS. Like 486SX-25s, the new 486DX2-50, your ZEOS *Editors' Choice '486* and more. A whole lot more. *Come on in!*

confidence in support, in your system and in the company as well. You can buy with confidence too because ZEOS is a strong and rapidly growing public company (NASDAQ NMS Symbol: ZEOS). In fact, *Fortune* magazine rated ZEOS as *America's Fastest Growing Company.*

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Power and Package you want or let us custom build your new system to your exact specifications! Whatever you decide, a friendly and knowledgeable ZEOS Systems Consultant is waiting to assist you. And whatever you select, one thing is for certain.

Buying your new ZEOS system is perhaps the best purchase decision you'll ever make. So why not give us a call right now. You're going to be very satisfied. We don't just say it. We guarantee it! *Call Now Toll Free, 800-423-5891.*

486DX-50	$2995
486DX2-50	$2895
486DX-33	$2695
486SX-25	$2595
486SX-20	$2495
386DX-33	$2395

PACKAGE #3

486DX-50	$3395
486DX2-50	$3295
486DX-33	$3095
486SX-25	$2995
486SX-20	$2895
386DX-33	$2795

PACKAGE #4

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Add even more memory, a larger drive. And more savings! You now receive:

- 4 full Megabytes of ultra-high-speed RAM.
- Our fast 130MB IDE hard drive with built-in cache.
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- ZEOS 14" 1024x768 non-interlaced VGA Color monitor w/Tilt & Swivel.
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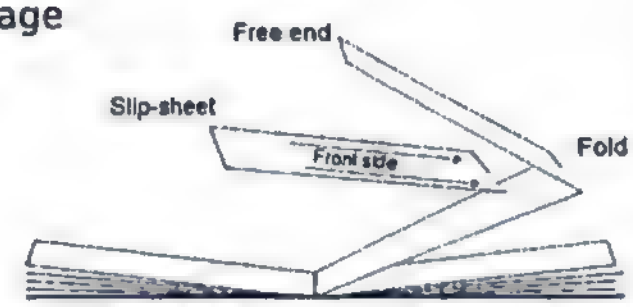
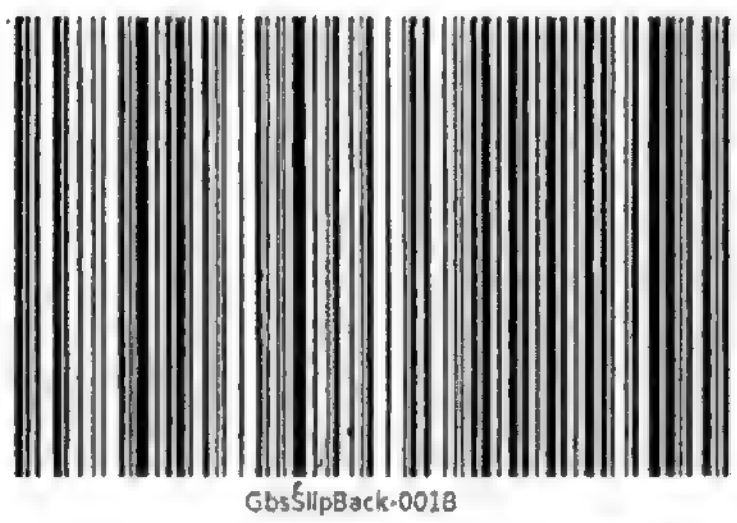
4. Close the page and slip-sheet





Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

smaller than many cases offering only five drive bays. Plus, we've also added a *second whisper-quiet cooling fan.* Why? Because the cooler a system runs the longer it will last. Now that's ZEOS Value. Speaking of which, here's another industry first you will definitely benefit from.

ZEOS ANNOUNCES: BUILT-IN SURGE SUPPRESSION!

Right now, ZEOS is proud to announce that we've taken our top-of-the-line *300 watt* supply and added a *built-in surge suppressor.* Building the surge suppressor right into the power supply increases reliability and helps protect your investment. We wonder how long it will take for the rest of the industry to catch up. And while ZEOS is giving you critically important features like these, we add yet another.

UL® Listing! As *PC Magazine* said, UL Listing is "one of the few forms of peace of mind you can buy." Every ZEOS system is Underwriters Laboratories Listed. This means your entire system (not just the power supply) has met the stringent safety requirements of Underwriters Laboratories. Not only that, but your ZEOS UL listing says a lot about quality too. UL safety listings are something many of our competitors simply don't (or can't) provide you. At ZEOS quality and safety are important to us. *You are important to us!*

24-HOUR-A-DAY TOLL-FREE TECHNICAL SUPPORT.

The importance of having you as a customer shows in many other ways as well. For example, at ZEOS we believe supporting *you* should be more than a part-time proposition. As *PC Magazine* said, "Insist on a good service and support package. Expect...24-hour seven-day-a-week support." We've been saying that for years. In fact, it was ZEOS that invented *24-Hour-a-Day Toll-Free Sales and Technical Support.* Our customers tell us they love it. And you will too. Any time you need assistance, a ZEOS technician is only a phone call away.

With ZEOS you can have complete

Great Prices. L

Now Pick 2: Lotus 1-2-3 for Windows, Ami Pro 2.0 and Freelance Graphics!

Or
Customize, Customize, Customize!
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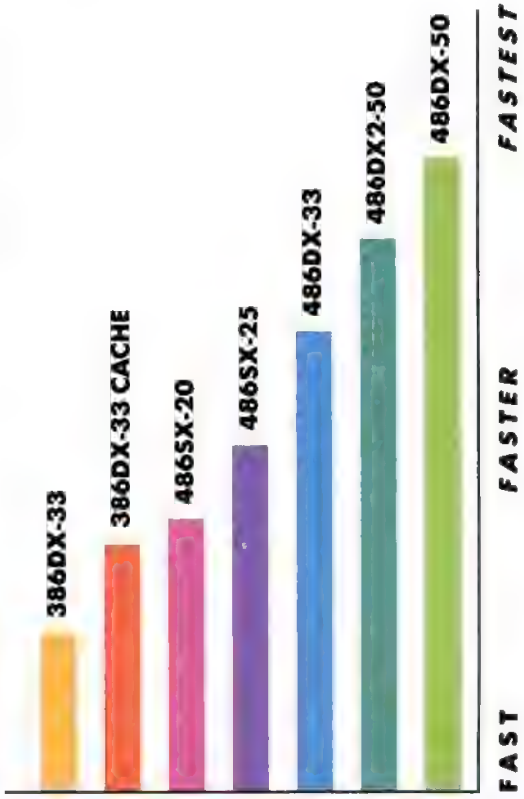
Pick Your Power!

Now, ZEOS lets you pick exactly the power you want for the price you want to pay. Simply match the processor with the package configuration and you have your price. Or if you wish, we will custom build any system to your exact specifications.

And don't forget, with every ZEOS Windows System (packages 2, 3 and 4) you'll also receive your choice of 2 out of 3: *Lotus 1-2-3 for Windows, Ami Pro 2.0,* and *Freelance Graphics.* The Lotus software alone carries a suggested retail of over $1,000 and even street prices are over $700. Yet we're giving it to you at *no additional charge!* That's ZEOS value.

No doubt about it. ZEOS has broken the price/performance



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Let the "Z-Graphometer" help you pick the processing power that's right for you. The comparisons are easy to make. Fast, Faster or Fastest!

ZEOS COMPLETE SYSTEM PACKAGE #1

- The processor and speed of your choice plus future upgradability!
- 1MB of high-speed RAM, expandable to a system total of 32MB right on the motherboard.
- 42MB high-speed IDE hard drive with its own cache.
- 1.2MB or 1.44MB Teac® floppy drive.
- ZEOS 14" flat screen Hi-Res amber monitor with Tilt/Swivel Base.
- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101-key SpaceSaver keyboard.
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- Seven drive bays and our custom 300 watt power supply with built-in surge suppressor!
- Includes ZEOS 24-Hour-a-Day Toll-Free Technical Support and Customer Satisfaction package.

INCREDIBLE ZEOS PACKAGE #2

We take Package #1 and upgrade your ZEOS Modular System to include:

- 2 full Megabytes of rip-roaring RAM.
- Our incredible 107MB IDE hard drive with its own built-in cache.
- Both the Teac® 1.2MB and 1.44MB floppy drives.
- Diamond Stealth VGA card/1MB RAM & Sierra DAC plus WinRIX drawing software!
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- Microsoft Mouse, Microsoft Windows and DOS, plus 2 out of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro 2.0, and Freelance Graphics!

barrier with these great new upgradables, and you're the beneficiary. Incredible power, upgradability, and free software. What more could there be? From ZEOS, lots more.

Because your new ZEOS system is not only fast, it's absolutely loaded with features. Like our 300 watt power supply with *built-in surge suppression,* eight expansion slots, twin cooling fans for even more reliability, plus our unique seven-bay SpaceSaver case. And, every ZEOS system is UL® listed.

And don't forget you're also receiving 24-Hour-a-Day Toll-Free Technical Support, our 30-day Absolute Satisfaction Money-Back Guarantee, Express Parts Replacement and more. So go ahead.

Pick your Power, your Package, and your Price and give us a call. Your friendly, expert ZEOS Systems Consultant is ready to answer any questions you may have. *Call Now Toll Free 800-423-5891.*

PACKAGES 2, 3 AND 4 INCLUDE LOTUS BUNDLE!

	Pkg. #1	Pkg. #2	Pkg. #3	Pkg. #4
386DX-33	$1395	$1895	$2395	$2795
486SX-20	$1495	$1995	$2495	$2895
486SX-25	$1595	$2095	$2595	$2995
486DX-33	$1695	$2195	$2695	$3095
486DX2-50	$1895	$2395	$2895	$3295
486DX-50	$1995	$2495	$2995	$3395

Add $200 to any price for a 128K cache.

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We also have our own ZEOS credit card, the Z-Card.® The Z-Card allows you to charge your ZEOS purchases just like a MasterCard or VISA. There is a low consumer rate and there is no annual fee. We can send you an application or you can apply right over the phone. Our special toll-free application number is 800-421-8942.

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Purchase orders from Fortune 1000 companies, governments and institutions are subject to credit approval. Wire transfer is also available. Please call 800-423-5891 for details.

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- ZEOS 14" 1024x768 non-interlaced VGA Color monitor w/Tilt & Swivel.
- Microsoft Mouse, Microsoft Windows and DOS, plus 2 out of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro 2.0, and Freelance Graphics!

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- 8 full Megabytes of high-speed RAM.
- Your screaming 210MB IDE hard drive with its own built-in cache.
- Teac® 1.2 & 1.44MB FDD'S!
- Diamond Stealth Hi-Color VGA card/1MB RAM (32,000+ colors) plus WinRIX drawing software!
- ZEOS 14" 1024x768 non-interlaced VGA Color monitor w/Tilt & Swivel.
- Microsoft Mouse, Microsoft Windows and DOS, plus 2 out of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro 2.0, and Freelance Graphics!

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If you thought power like this was out of your budget, take another look. While many of the others don't even offer 50MHz power, *you can own the new ZEOS 486DX2-50 starting complete for as low as $1895, or the full-blown 486DX-50 for as low as $1995!*

Select from any of four money-saving packages. Or, if you wish, let us custom-build your hot new 486-50 to your exact specifications.

ZEOS POWER GRID FOR THE 486DX2-50

Apply The "Zeos Power Grid" To Match Your 50MHz Needs. Add $200 for 128K cache. Prices shown are for Intel 486DX2-50 CPU; for 486DX-50 add $100.

	Intel 80486DX2-50MHz	Upgradable CPU	1MB High Speed RAM	2MB High Speed RAM	4MB High Speed RAM	8MB High Speed RAM	42MB HDD, Fast IDE	107MB HDD, Fast IDE	130MB HDD, Fast IDE	210MB HDD, Fast IDE	Teac 1.2 Floppy Drive	Teac 144 Floppy Drive	14" Hi Res TTL Monitor	14" VGA Mono Monitor	14" VGA Color 1024 x 768 NI	Monitor Tilt & Swivel	Hercules® Graphics Card	Hi-Color VGA Card, 1MB	Sierra DAC	Shadow RAM/EMS Support	ZEOS/RS 101 keyboard	2 serial, 1 parallel, 1 game port
Pkg. #1 Only $1895	■	■	■				■				■		■		■	■				■	■	■
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WHAT SHOULD I GET?

How should you configure your new ZEOS 486-50? Of course the best answer depends on your needs and what you plan to use your new system for. But never before has so much power been available to everyone at such a low price. Our suggestion would be to consider investing in two areas when you buy your new 50MHz system. The memory and drives. Particularly the memory.

From what we're hearing, memory will be important with the new operating systems debuting later this year. We would strongly recommend at least 4 megabytes, eight if it's in the budget. As for drives, think in terms of 100+ megabytes; applications just don't seem to be shrinking (however, before you go too wild, remember you can always add more drives). Both of our Packages #3 and #4 incorporate these suggestions.

Certainly another option you may want to consider is our Vertical case. This heavy-

ZEOS 486-50

ZEOS Breaks the '486-

duty case holds more drives than most others and has a top-notch power supply and plenty of cooling.

It really is quite a buy. The power supply is the *TurboCool 300 watt* unit (check the retail price of the power supply alone if you really want to see what a good deal you're getting). It's well worth considering.

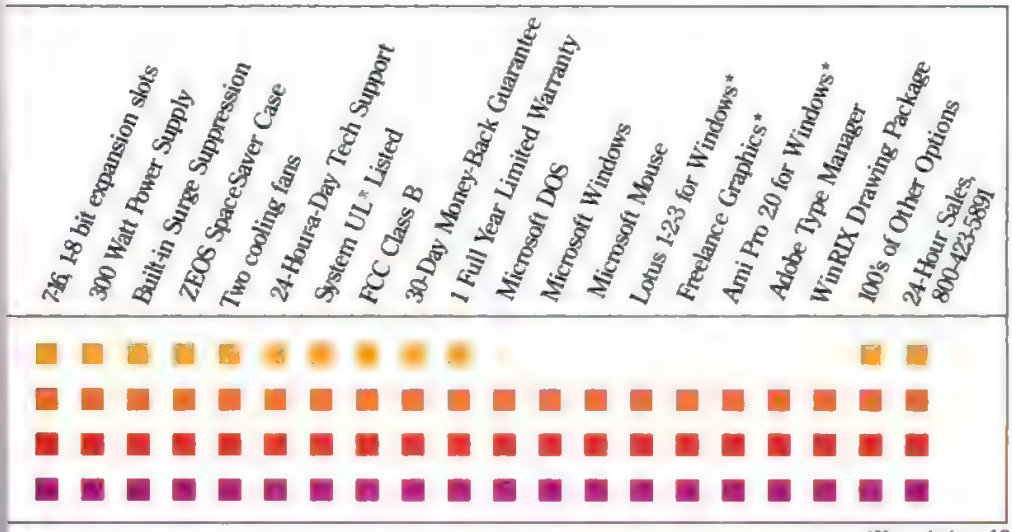
YOUR ZEOS EXTRAS. NO EXTRA CHARGE.

And don't forget, if you purchase a ZEOS Windows system we'll also include your choice of 2: *Lotus 1-2-3 for Windows, Ami Pro 2.0,* and *Freelance Graphics.* You'll be getting all the other ZEOS extras too.

If you don't go with the Vertical case, we'll send your 486DX2-50 in our seven-bay SpaceSaver case; it's complete with our top quality *300 watt* power supply, *built-in surge suppressor,* and *two* whisper-quiet cooling fans.

Remember too, ZEOS also provides you with 24-Hour Support, our 30-Day Money-Back Guarantee, One Full Year Limited Warranty and our Express Parts Replacement Policy.

Ordering your new ZEOS is easy. Simply give us a call. You're going to love your new ZEOS '50. And that's a guarantee! *Call now Toll Free 800-423-5891.*



*Your choice of 2

Consider the Vertical Option. We can build your new upgradable system in our eight bay vertical case. It comes complete with the 300 watt TurboCool power supply and two cooling fans. Add only $150.

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50MHz Price Barrier!

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Take Your Pick. We'll Ship Today!

RIGHT NOW. GUARANTEED!*

Yes, we can ship your new ZEOS '386 or '486 today! We've built up an extra supply of the hottest selling computers in America in their most popular configurations.

Here's how it works. We have these incredible ZEOS '386 and '486 color VGA systems pre-built and ready to ship. While supplies last, we will ship any of these systems to you *the day you order* subject to these conditions:

1. Your order must be received by 1PM Central Time M-F.
2. Credit Cards are subject to authorization.
3. Orders must be for ZEOS '386 or '486 systems configured as shown here. Any other systems or upgrades are custom-built and will take slightly longer.

Yes! We can ship your new ZEOS system Right Now! Place your order by 1:00 PM Central Time and we'll ship today. Guaranteed!*

***OUR GUARANTEE TO YOU:**

If we accept your order for immediate shipment and fail to ship your system under the conditions outlined, we will ship it at *our expense* as soon as it is ready.

This offer is good only as long as these pre-built systems remain in stock; please give us a call to verify availability. This offer does not apply to other ZEOS systems or custom configurations.

IMMEDIATE SHIPMENT IS ONLY PART OF THE STORY.

These are not just any computer systems. They're the high performance, high quality ZEOS *upgradable* systems. Packing all the ZEOS value that has won PC Magazine Editors' Choice—*nine times!*

So why not give us a call right now. If we hear from you by 1:00 this afternoon, we'll get your new system on the way to you today! Call now Toll Free 800-423-5891.

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- Shadow RAM and EMS support for enhanced performance.
- ZEOS/RS 101-key SpaceSaver kbd.
- High-speed ZEOS I/O with two serial, one parallel & one game port built in.
- 7-16, 1-8 bit expansion slots. Math coprocessor support for '386.
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Here's another great reason to buy a ZEOS system: the Z-Card*! The Z-Card works just like a MasterCard or VISA—so you can charge your ZEOS purchases and pay in easy monthly installments. And with no annual fee and a low interest rate, it makes buying your new ZEOS system easier than ever!

You can apply for your very own Z-Card and low, low monthly payments right now. Simply fill out the application below and fax it to 612-633-7507. Or mail it to *ZEOS International, Z-Card Processing Center, 530 5th Ave. NW, St. Paul, MN 55112.*

We'll contact you as soon as your credit line is established, usually within 24 hours of receipt. Apply today!

Apply for your own Z·Card® today!

No Annual Fee!

A. YOUR PERSONAL INFORMATION

Please complete all appropriate sections, *providing at least two years residence and employment history. THIS IS NOT A CREDIT AGREEMENT!* One will be sent to you upon authorization of an account. (This form must be signed to process your order.) All financed purchases are subject to credit approval. *If you have any credit questions, please call 800-421-8942 for assistance.* Thank you!

Name _____

Home Phone (____) _____

Soc. Sec. No. _____ Date of Birth ___/___/___

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary $ _____ Daytime Bus. Phone (____) _____

Previous Employer _____ From _____ To _____

Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT.** Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS:
☐ married ☐ unmarried ☐ legally separated

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income $ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE A:

Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	___	_____	Dept. Store Charge Card	___	_____
VISA	___	_____	Credit Union Account	___	_____
MasterCard	___	_____	Other Major Charge Cards	___	_____
Finance Company Loan	___	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ___/___/___

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (____) _____ Monthly Gross Salary $ _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____

Date _____

Joint Applicant's Signature _____

Date _____

FOR MARRIED WISCONSIN APPLICANTS: I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

Buyer's Signature _____

Date _____

There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or 612-635-0613 or write to ZEOS, Z-Card Processing Center, 530 5th Avenue N.W., St. Paul, MN 55112.

NY—A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH—The Ohio laws against discrimination require that all creditors make credit equally available to all creditworthy customers and that credit reporting agencies maintain separate credit histories on each individual upon request. The Ohio Civil Rights Commission administers compliance with this law.

*Financing not available in Alaska, Hawaii or outside the continental U.S.

Z-C/U

Z-CARD PRIORITY APPLICATION FAX NUMBER: 612-633-7507

CIRCLE 115 ON READER SERVICE CARD

BENCHMARK TESTS

A little extra cache goes a long way in terms of processor and memory performance. Systems that contained 256K of cache eked out better scores in both these categories. A coprocessed caching disk controller caused the BOSS's disk score to soar; PCs with S3-based video controllers won the Windows graphics race.

WHAT THE NUMBERS MEAN

Of the 19 50-MHz 486-based PCs in this review, 16 showed closely grouped processor test scores—all falling within a 5 percent band. The other three units—from SVC, CUI, and Club—posted the lowest scores. All three used 64K cache implementations, whereas the rest had 128K or larger processor RAM caches. The 128K No-Operation segment of PC Magazine Labs' processor test caused cache misses in systems with 64K SRAM implementations, therefore bringing about lower processor scores.

The BOSS and the PCI used 128K implementations, while the other 14 systems in this subgroup had larger, 256K cache designs. The Compaq, the only system to use Intel's 82495 cache controller (two-way set-associative, write-back) with a 256K SRAM, was the memory performance leader. This system also featured Compaq's proprietary memory expansion adapter.

By contrast, the BOSS's memory performance fell nearly 50 percent below the group's average. This system's upgradable motherboard design supports a family of proprietary plug-in processor cards, from a 20-MHz 486SX module to the 50-MHz 486DX, and may account for the poor memory performance.

DISK

Our tests showed a wide range of scores, frequently based on the cache installed on the controllers. One system, the BOSS CEO, contained a controller with a 4MB cache and a 16-MHz 386SX; the remaining high scorers had caching hard disk controllers without the processor.

Of the five EISA systems in this review, only the BOSS revealed superlative disk performance—the best seen by PC Labs thus far—thanks to AMI's Fast Disk controller, a 32-bit SCSI EISA card with a 386SX/16 microprocessor and a 4MB cache. Paired with a Seagate ST1480N hard disk, its benchmark test scores were close to 2MB per second—nearly three times as fast as the Axik Ace Cache 486/WB/50, which combined a 4MB Promise Technology Model 2031 caching IDE controller and a Seagate ST2383A hard disk. This subsystem logged in at 700 kilobytes per second (KBps), which is still an extremely fast score. The Club Falcon 450T also used the same Model 2032 controller and scored on a par with the Axik.

The ACMA and the Amax, which use UltraStor Ultra 15C controllers with Quantum ProDrive units, turned in disk times close to 475 KBps. Three systems using Maxtor's LXT-340A hard disk followed at the 300- to 350-KBps plateau—the CUI, ATronics, and C².

The remaining 11 systems were closely grouped on the lowest disk-performance plateau, ranging from a 170-KBps tie between the Dell and the Silicon PCs to the 80-KBps bottom performer, the Diamond PC.

VIDEO

With this issue, we introduce the graphics Winmark, the geometric mean of 11 graphics tests in the WINBENCH 2.5 Windows performance test suite. Computers with S3-based video subsystems outperformed Tseng- and Trident-based systems in WINBENCH testing, but the converse was true for DOS-based video tests.

Seven systems—the SST, Axik, Polywell, C², Mega, EPS, and Amax—relied on S3 accelerator designs and turned in Winmarks nearly six times as high as those based on the Trident and Tseng adapters. The Compaq, with its proprietary video implementation, ranked ninth on Windows performance, well below the S3-based systems but better than Tseng and Trident designs.

The Dell's proprietary video implementation, using the Tseng chip set, produced the best DOS video score; the adapters found in the Intelec, Diamond, and Club performed nearly as well. The PCI, which used Tseng's own video adapter/driver combination, performed poorly. Trident's cards, found in the Silicon and the ATronics, also were among the slowest performers.

HOW WE TESTED

PC Magazine Labs' Hardware Performance Tests, Release 6.0, measure the PC's processor, memory, disk, and video subsystem performance. Each test measures the number of operations performed or the data throughput over a period of time. We mathematically reduce the raw scores to yield an appropriate mean. The three-dimensional bar chart shows the relative performance of the tested machines, with the average set at 100. In all cases, a larger number means better performance.

We performed all the tests with the RAM and video cache shadowing enabled whenever possible. We report the disk performance without software disk caches.

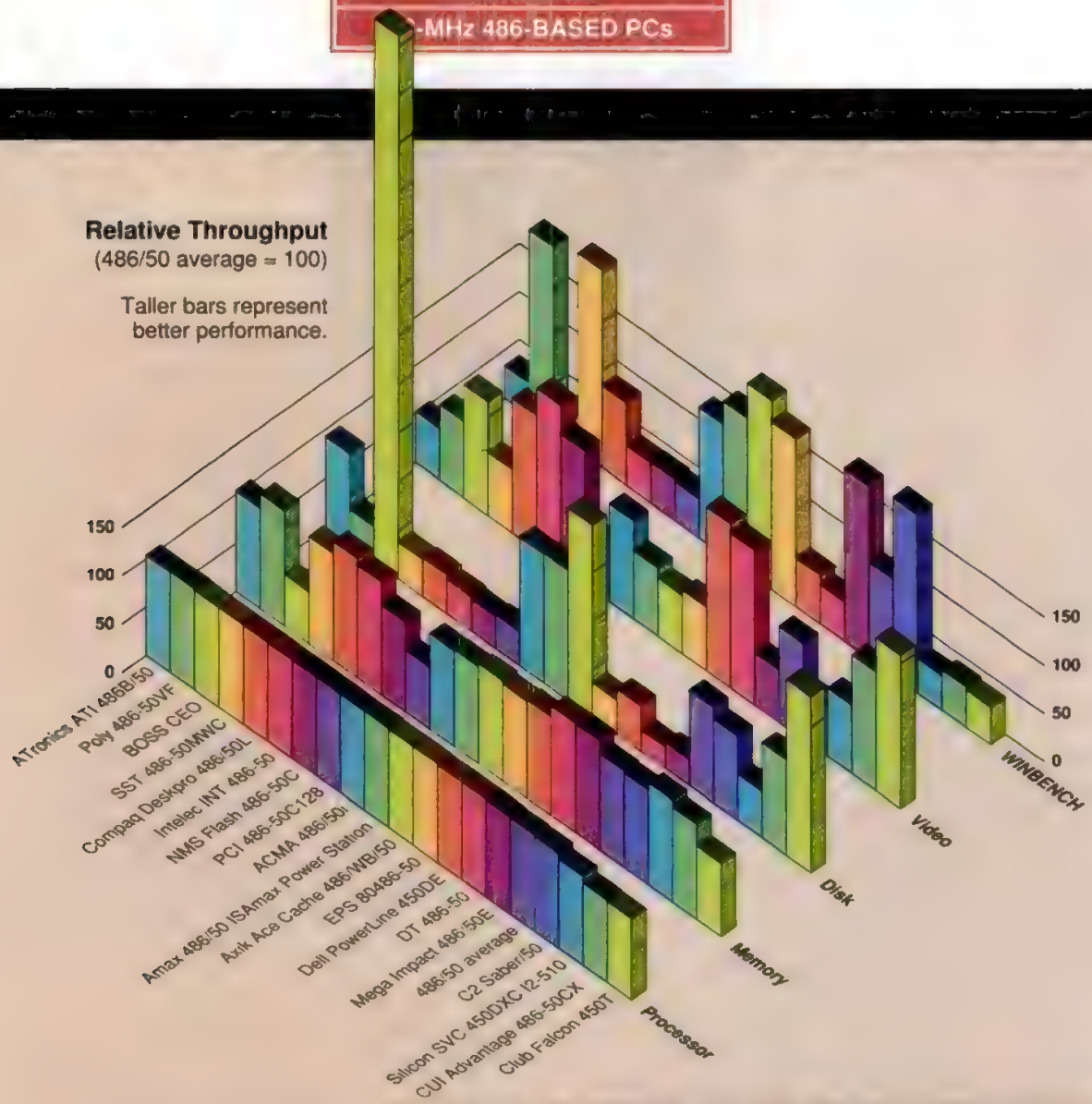
■ The **processor** benchmark test measures different aspects of the CPU's performance and its interaction with cache and main memory. The test consists of eight routines: an Instruction Mix native to the microprocessor type (386 or 486, for instance), 128K No-Operation, Do-Nothing, Integer-Add, Integer-Multiply, Floating-Point Mix, String-Sort and -Move, and Prime-Number Sieve routines. We report the results in processor operations per second.

■ The **memory** benchmark test measures the read/write performance of the computer's first 640K of conventional memory. We report the results in kilobytes per second.

■ The **disk** benchmark test evaluates the mechanical drive speed, hard disk controller functions, and bus speed, using a series of small-record (512-byte and 4K) exercises followed by similar large-record (16K and 32K) exercises. Both small- and large-record exercises include file-create, sequential write/read, and random write/read operations. We report the results in kilobytes per second.

■ The **video** benchmark test consists of text and graphics routines. In the Direct Screen Write routine, the video adapter's screen memory writes text to the screen. The test then performs several graphics operations, including screen fills and bit-block transfers (BitBlts). We report the results in thousands of video operations per second.

■ With the release of Version 2.5 of PC Labs' WINBENCH tests (our graphics performance tests for Microsoft Windows), PC Labs has introduced a new method of measuring graphics performance. The graphics Winmark (our **WINBENCH** score) is actually the geometric mean of 11 WINBENCH graphics tests, measured in kilopixels per second. PC Labs profiled the major Windows applications in November 1991 and determined which graphics functions are most frequently used within Windows. The Winmark takes into account 11 tests of these key functions and weights them to reflect how frequently the functions are used. Windows applications also use other graphics functions, but far less often.



Higher scores represent better performance.

	Processor (operations per second)	Memory (kilobytes per second)	Disk (kilobytes per second)	Video (thousands of operations per second)	WINBENCH (kilopixels per second)
ATronics ATI 486B/50	532	8,359	327	1,391	2,062
Poly 486-50VF	532	9,549	130	2,027	11,760
BOSS CEO	531	4,283	1,976	3,015	1,985
SST 486-50MWC	531	8,882	136	1,659	12,428
Compaq Deskpro 486/50L	529	9,903	145	3,588	5,183
Intelec INT 486-50	529	9,397	126	4,326	2,468
NMS Flash 486-50C	528	7,533	121	3,579	2,559
PCI 486-50C128	528	5,204	127	1,454	2,408
ACMA 486/50i	527	8,044	470	2,661	8,157
Amax 486/50 ISAmax Power Station	527	8,064	476	1,855	9,600
Axik Ace Cache 486/WB/50	526	8,325	699	1,561	11,827
EPS 80486-50	523	8,067	128	1,715	10,478
Dell PowerLine 450DE	521	8,253	170	4,417	3,093
DT 486-50	521	9,125	81	4,193	2,480
Mega Impact 486/50E	521	9,102	98	1,424	10,815
486/50 average	514	8,017	352	2,605	6,087
C² Saber/50	509	7,855	311	1,360	11,256
Silicon SVC 450DXC I2-510	477	8,386	170	1,886	2,207
CUI Advantage 486-50CX	441	7,888	348	3,240	2,541
Club Falcon 450T	438	6,106	641	4,149	2,352

DELL COMPUTER CORP.

Dell PowerLine 450DE

by Dan Smith

Like others in the PowerLine series, the EISA-based Dell PowerLine 450DE's motherboard integrates nearly everything but the processor itself. This versatile design lets you specify your processor (from a 20-MHz 486SX to a 50-MHz 486DX), and you can use or upgrade the slot-saving video and disk control circuitry that comes as part of the system.

Our $7,976 test unit had 8MB of RAM, a 128K cache, and a 345MB ESDI hard disk. Designed as a small-footprint desktop that measures 6 by 16 by 16 inches, the PowerLine 450DE still manages to have enough space for five drives. If you want your power in a compact package, this chassis is just the right size.

Dell Computer Corp. uses its own motherboard, chip set, cache controller, and proprietary processor card. The chip set is programmable in BIOS, has cached BIOS and video shadowing, and flash EEPROM for BIOS upgradability. The motherboard holds six 32-bit EISA slots, an on-board IDE hard disk and disk/tape drive interface, and four ports (one parallel, two serial, and one mouse). Dell also includes Tseng chip–based Super VGA circuitry on the motherboard. You can disable any or all of these connections.

Dell's 6.5- by 5-inch processor card holds the 50-MHz 486DX CPU, clock crystal, and a write-through controller that handles a 128K look-through, direct-mapped cache. The motherboard has six SIMM sockets that hold a maximum of 96MB on the motherboard, using 16MB SIMMs. The motherboard can be set to zero wait states in a burst-interleaved page mode.

PC LABS' BENCHMARK RELEASE 6.0

Dell PowerLine 450DE

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	521	438	532	514
Memory	8,253	4,283	9,903	8,017
Disk	170	81	1,976	352
Video	4,417	1,360	4,417	2,605
WINBENCH	3,093	1,985	12,428	6,087

In Short: IDE, I/O, and video circuitry are integrated onto the motherboard of the $7,976 Dell PowerLine 450DE. This small-footprint EISA desktop had processor and memory scores in line with those of the better machines tested here, but its disk performance was slow compared with systems with larger disk caches. It beat all others on the video test, but its WINBENCH graphics score was in the middle of the pack.

Dell PowerLine 450DE, $7,976

Though the PowerLine 450DE's design includes IDE circuitry, the company shipped our test unit with an ESDI hard disk and controller. An UltraStor Ultra 22C disk controller with a 2MB cache was paired with a Micropolis 345MB hard disk rated at 14 milliseconds.

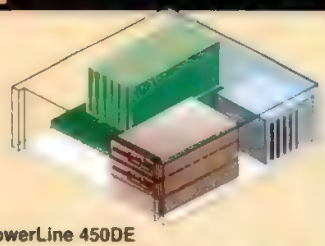
The PC's video subsystem includes a VESA-standard Dell UltraScan 14C 14-inch Super VGA monitor, which can display 1,024-by-768 noninterlaced resolution at 72 Hz. Dell will sell you any number of video upgrades, including ATI Technologies' Vantage or Ultra cards, however. If you plan to work in Microsoft Windows, you should probably consider such upgrades: The Vantage adds $300 and the Ultra $400 to the price.

Its processor and memory scores were in line with those of the other machines tested here. On the other hand, its disk and WINBENCH scores were somewhat disappointing. Though Dell sent an ESDI hard disk instead of using the IDE controls found on the PC's motherboard, the move did not pay off. The cached disk controller and hard disk (rated at 14 ms.) yielded scores that were nonetheless well below the group's average. In addition, though the motherboard-based video beat all others on the video test, the PowerLine 450DE's WINBENCH score was midpack. This implementation performed somewhat better on the WINBENCH test than any other Tseng chip–based video subsystem, but it could not match any of the accelerated cards.

The Dell PowerLine 450DE comes with a one-year warranty on parts and labor, which includes one year of free on-site service by BancTec Service Corp. Extended service contracts are available, and the price depends on the system configuration. You can get free technical support on an 800 line weekdays from 6:00 A.M. to 9:00 P.M. C.S.T., Saturdays from 8:00 to 4:00, and Sundays from 10:00 to 3:00. Dell mirror-ships and pays return shipping charges.

FACT FILE

EDITORS' CHOICE



Dell PowerLine 450DE
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78750; 800-289-3355; fax, 512-343-3312.
List price (tested configuration): $7,976.
Memory and processor RAM cache: 8MB 80-ns. SIMMs, 128K cache.
Disk drives and controller: Micropolis 14-ms. 345MB ESDI hard disk, UltraStor controller, 2MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Tseng 1,024-by-768 adapter with 1MB RAM, Dell 14-inch monitor, 72-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.0.
CIRCLE 496 ON READER SERVICE CARD

DIAMOND TECHNOLOGIES INC.

DT 486-50

by Mario Baldasserini

With an EISA-bus design and a roomy tower case, Diamond Technologies' DT 486-50 is well suited to network use. Besides selling a full line of Ethernet adapters, Diamond installs and supports *NetWare*, Version 3.11.

Our $3,499 test unit had 8MB of RAM, a 256K cache, and a 360MB uncached SCSI hard disk. The direct-mapped cache is controlled through discrete logic. The unit's RAM came in 1MB 60-nanosecond SIMMs; you would have to replace them with 4MB SIMMs to reach the 64MB maximum.

With one parallel- and two serial-port connectors integrated onto the motherboard, six of the eight 32-bit EISA slots are free once the video adapter and the BusTek SCSI controller are installed. The DT 486-50's 24.5- by 8.5- by 16.5-inch

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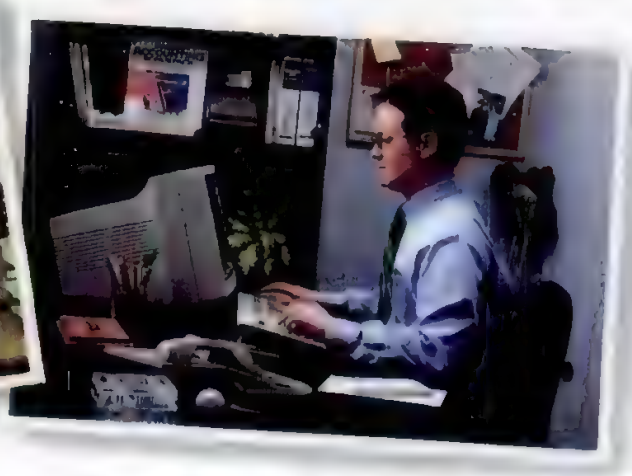

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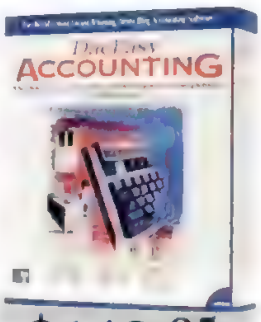
CIRCLE 022 ON READER SERVICE CARD



$149.95

DT 486-50, $3,499

tower case has ten half-height drive bays: six accessible (four 5.25-inch and two 3.5-inch slimlines) and four internal.

The hard disk subsystem consists of a 16-millisecond Maxtor XT8380S hard disk with an EISA BusTek BT-742A SCSI controller. The video system is based on the Diamond SpeedSTAR Super VGA board with 1MB of video RAM, a Tseng ET4000AX chip set, and a Sierra Hi-Color RAMDAC. The TVM-4A Multisync monitor can display 256 simultaneous colors at 1,024-by-768 noninterlaced with a 70-Hz vertical refresh rate.

On our processor test, the DT 486-50 placed among the top machines, whose 256K of RAM cache gave them very similar scores. Apart from that, its most notable performance was on the memory and video tests. On memory, the 256K cache and speedy 60-ns. DRAM gave the system an above-average score. The uncached disk subsystem placed last on our disk test and fell below other uncached disk subsystems. In terms of video, the PC showed typical Tseng chip–based video characteristics: good video performance but WINBENCH scores that cannot compete with those of accelerated video cards.

The documentation, which was informative and easy to read, consisted of different pamphlets for the video and hard disk controller and a general pamphlet for the system itself.

Diamond offers a solid warranty with a solid machine. The DT 486-50's warranty covers parts for 15 months and labor for 24 months. On-site service from GE Computer Service is available as a $50 option; the estimated response time is from 4 to 8 hours. For the second year, you can buy an extended service contract for 10 percent of the original price. Toll-free technical support operates weekdays from 8:30 to 5:30 P.S.T. If you don't elect on-site service, Diamond makes the repairs and pays all shipping charges for the first four months; after that, it pays for return shipping only.

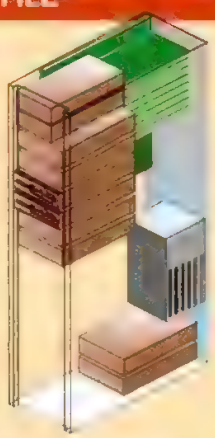
PC LABS' BENCHMARK RELEASE 6.0

DT 486-50

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	521	438	532	514
Memory	9,125	4,283	9,903	8,017
Disk	81	81	1,976	352
Video	4,193	1,360	4,417	2,605
WINBENCH	2,480	1,985	12,428	6,087

In Short: An EISA tower, the $3,499 DT 486-50 turned in high performance on our processor, memory, and video tests. Its WINBENCH graphics performance was comparable with that of other non-GUI systems, but the lack of a disk cache hampered the unit on our disk test. Diamond also installs and services *NetWare*.

FACT FILE



DT 486-50
Diamond Technologies Inc., 1755 Von Karman Ave., Irvine, CA 91714; 800-989-7253, 714-252-1008; fax, 714-252-1508.
List price (tested configuration): $3,499.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Maxtor 16-ms. 360MB SCSI hard disk, BusTek controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, TVM 14-inch monitor, 70-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 497 ON READER SERVICE CARD

EPS TECHNOLOGIES INC.

EPS 80486-50

by Bruce Brown

EPS Technologies' *NetWare*-certified EPS 80486-50 ISA tower system is intended for use as a file server and is a good buy. An average performer on PC Magazine Labs' benchmark tests, the EPS has good drive expansion room with eight drive bays, but this PC has a 32MB RAM limitation—a low amount of memory for a category of systems that are often network servers.

EPS 80486-50, $4,150

The $4,150 list price includes 8MB of RAM, a 256K cache, and a 340MB hard disk. The EPS's motherboard is manufactured by Contaq to EPS specifications and includes AMI ROM BIOS and Contaq support chips, including a Contaq controller for the two-way set-associative write-back RAM cache. Neither I/O, video adapter, nor drive circuitry is integrated onto the motherboard; therefore, cards for those purposes use three of the motherboard's eight expansion slots.

Eight SIMM sockets can hold the sys-

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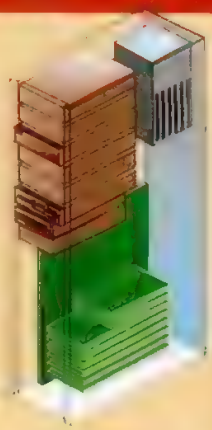
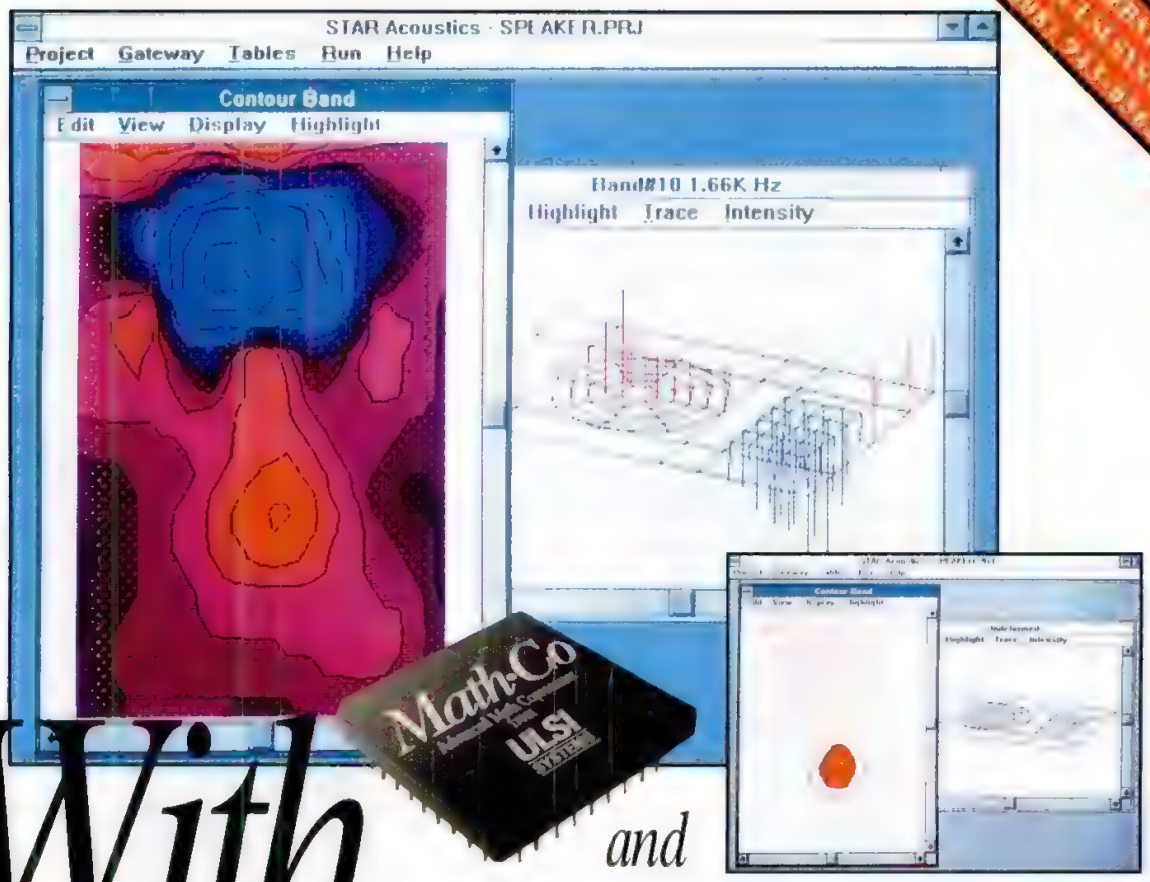


EPS 80486-50
EPS Technologies Inc., 10069 Dakota St., P.O. Box 278, Jefferson, SD 57038; 800-447-0921, 605-966-5586; fax, 605-966-5482.
List price (tested configuration): $4,150.
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 256K cache
Disk drives and controller: Micropolis 14-ms. 340MB SCSI hard disk, UltraStor controller, 64K buffer, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, Sony 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 498 ON READER SERVICE CARD



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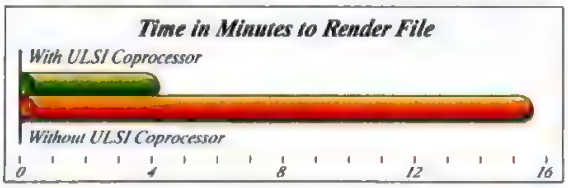

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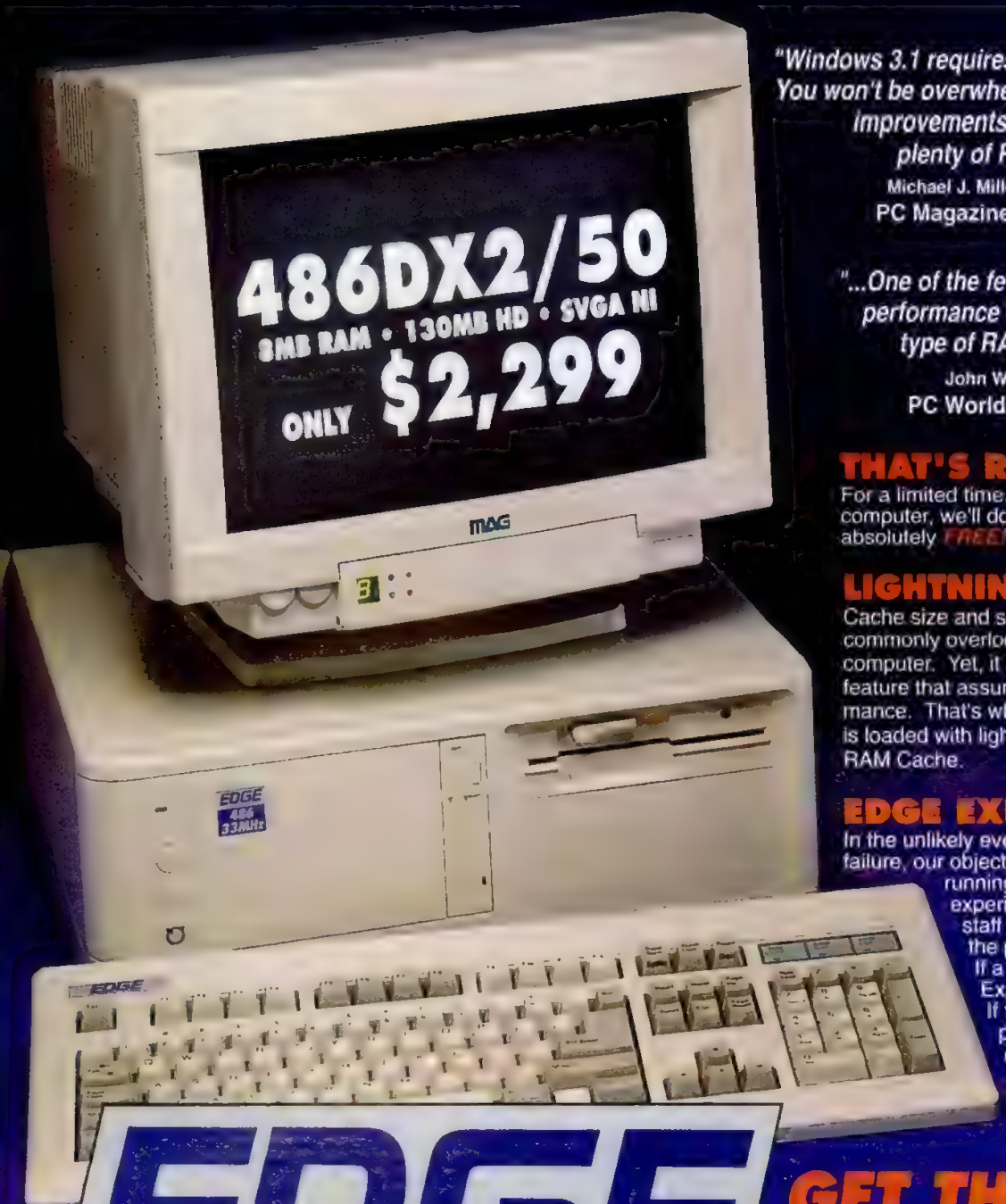

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Michael J. Miller, Editor-in-Chief
PC Magazine, April 28, 1992

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John Walkenbach
PC World, April 1992*

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486DX/33	130MB	210MB	340MB
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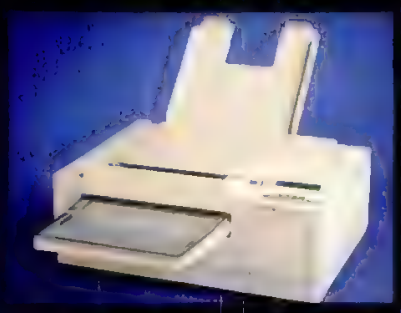

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386DX/33	80MB	130MB	210MB
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15" MAG/Eclipse II	$2,049	$2,149	$2,299

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386SX/20	80MB	130MB	210MB
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CIRCLE 119 ON READER SERVICE CARD

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tem's maximum 32MB of RAM; for upgraders, EPS has a welcome memory-chip rebate program if you are left with unneeded SIMMs.

The tower case measures 24.5 by 7.5 by 17.5 inches. The case can accommodate two internal 5.25-inch drives and has bays for six drives that can use removable media, four 5.25-inch and two 3.5-inch drive bays. The test system's UltraStor Ultra 14F SCSI controller has a 256K cache and is paired with a Micropolis 340MB 14-millisecond hard disk. The video setup consists of an Orchid Fahrenheit 1280° display adapter and a Sony CPD 1304 Multiscan HG 14-inch monitor, which supports a maximum 1,024-by-768 noninterlaced resolution and has a 72-Hz vertical refresh rate.

Benchmark performance for the EPS was acceptable if undramatic for this group of fast systems. Its processor and memory scores were average. The SCSI controller did not fare well on the disk test compared with other tested systems with cached disk controllers. The Orchid Fahrenheit 1280° display adapter's S3 video accelerator chip helped the system achieve above-average WINBENCH scores but, as is typical for accelerator chip–equipped systems, its video score was slower.

The EPS 80486-50 comes with a standard one-year warranty on parts and labor and includes a longer-than-usual 60-day money-back guarantee. Toll-free technical support is available Monday through Friday from 7:00 A.M. to 10:00 P.M. C.S.T. and Saturday from 9:00 to 3:00. Free on-site service by Idea ServCom is provided the first year. The documentation is an adequate but uninspiring mix of an original general section and manuals for the specific components.

PC LABS' BENCHMARK RELEASE 6.0

EPS 80486-50

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	523	438	532	514
Memory	8,067	4,283	9,903	8,017
Disk	128	81	1,976	352
Video	1,715	1,360	4,417	2,605
WINBENCH	10,478	1,985	12,428	6,087

In Short: Housed in an eight-bay ISA tower, the $4,150 EPS 80486-50 turned in satisfactory processor and memory test scores. Its disk score was average for a noncached system but low when compared with cached PCs. Its S3 accelerator scored typically high on the WINBENCH graphics test and typically low on the video test.

INTELEC CORP.

Intelec INT 486-50

by William P. Flanagan

The ISA-based Intelec INT 486-50 has good processor and memory performance and represents a well-priced ISA box. Intelec Corp. targets this PC as a high-end workstation. The company resells *NetWare* but does not install it or offer a network-specific repair service; the Intelec is not *NetWare*-certified.

Our $3,799 tested configuration came with 8MB of RAM in 1MB SIMMs, a 256K processor RAM cache, and a 340MB SCSI hard disk. The 24- by 7- by 18-inch tower case has a 250-watt power supply with four device connectors. Four of the six 5.25-inch drive bays are front-accessible. In our test unit, three were empty; the rest were occupied in the traditional way: The hard disk took up the internal bays, and the 1.2MB and 1.44MB floppy disk drives used the accessible bays.

Our test unit came with a relatively unknown motherboard, labeled Octek Hippo II. Even so, the board contains familiar chips—an AMI BIOS and an OPTi chip set, for instance.

The Hippo motherboard has six 16-bit ISA slots and a socket for a Weitek coprocessor. Only three of our test unit's slots were open after we installed the disk controller, I/O card, and video adapter, though an 8-bit slot and a proprietary 32-bit slot were also open.

If you wish to upgrade the memory beyond the initial 8MB, Intelec will take back the installed 1MB SIMMs and give you a $350 rebate that reduces the cost of an upgrade to 32MB from $1,200 to $850. To expand to the system's 64MB maximum, you have to use the proprietary 32-bit slot.

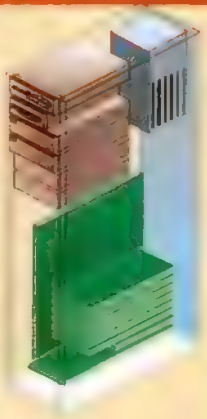
The Intelec was one of four systems in this roundup to use a SCSI hard disk interface. An uncached UltraStor controller was paired with the Micropolis hard disk, which is rated at 14 milliseconds. The video subsystem consisted of a Diamond SpeedSTAR Super VGA adapter with a Tseng ET4000AX chip set paired with an Optiquest 1000D Super VGA monitor that had a maximum noninterlaced resolution of 1,024 by 768 and a vertical refresh rate adjustable from 47 to 90 Hz.

Intelec INT 486-50, $3,799

On PC Magazine Labs' benchmark tests, the Intelec turned in an above-average memory score, thanks to its 256K write-back cache and 70-nanosecond RAM. On our processor test, the Intelec performed well, though most of the tested PCs scored so closely that none stood out from the pack. The Intelec did well on the video test but turned in a below-average result on the WINBENCH test—in line with the performance of other non-GUI-accelerated systems. Lack of a disk cache gave the PC a below-average score on our disk test—again, comparable with that of other noncached disk subsystems.

The main manual was written for Intelec's entire line rather than specifically for the Intelec INT 486-50. The mother-

FACT FILE



Intelec INT 486-50
Intelec Corp., 6075 NW 82nd Ave., Miami, FL 33166; 800-683-0969, 305-594-0001; fax, 305-477-9074.
List price (tested configuration): $3,799
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 256K cache.
Disk drives and controller: Micropolis 14-ms. 340MB SCSI hard disk, UltraStor controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, OPTiQuest 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 5.0.

CIRCLE 499 ON READER SERVICE CARD

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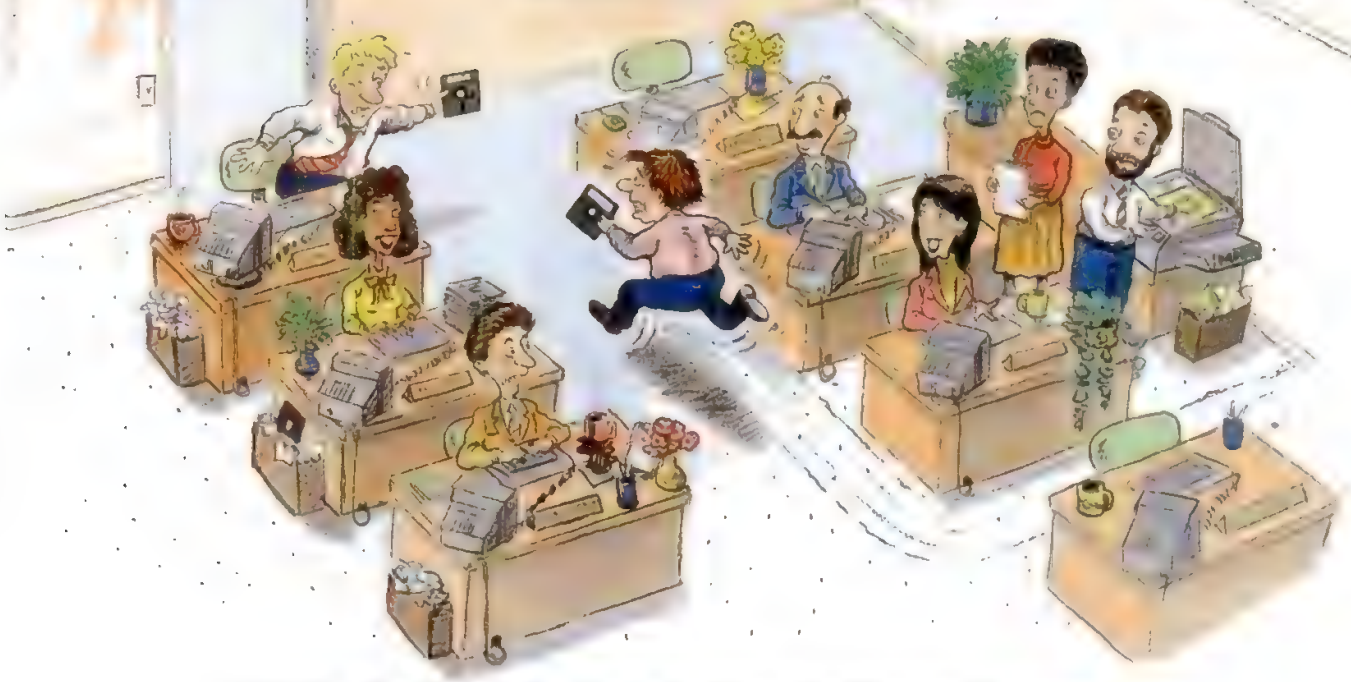

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CIRCLE 127 ON READER SERVICE CARD

PC LABS' BENCHMARK RELEASE 6.0

Intelec INT 486-50

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	529	438	532	514
Memory	9,397	4,283	9,903	8,017
Disk	126	81	1,976	352
Video	4,326	1,360	4,417	2,605
WINBENCH	2,468	1,985	12,428	6,087

In Short: Aggressive pricing and above-average performance on our processor, memory, and video tests characterize the $3,799 ISA-bus Intelec INT 486-50. Its video and WINBENCH graphics performance was similar to that of other units without a GUI accelerator, and its disk score was slow in terms of cached systems but average for a noncached PC.

board and the video components are discussed in separate manuals. Intelec offers a one-year parts-and-labor warranty. On-site service from Computer Technology Services costs $49 the first year. Technical support, free but not toll-free, is available Monday through Friday from 9:00 to 6:00 E.S.T. and Saturdays from 10:00 A.M. to 2:00 P.M.

MEGA COMPUTER SYSTEMS

Mega Impact 486/50E

by Jim Beltran

Eight EISA slots and eight drive bays make the Mega Impact 486/50E a candidate for server use. The computer's standard parts turn in performance that is on a par with other similarly configured systems.

Our $4,450 test unit included 8MB of RAM, a 256K cache, and a 340MB SCSI hard disk, all in a 24.5- by 7.5- by 17.5-inch tower case. All eight of the system's drive bays—four externally accessible and four internal—are 5.25-inch half-heights and are matched by a 250-watt power supply with six connectors. One internal bay held the hard disk; 1.2MB and 1.44MB TEAC floppy disk drives filled two of the accessible bays.

The full-size motherboard, designed and manufactured by Advanced Integration Research (AIR), can accept up to 64MB of RAM; it uses an AMI BIOS and Intel chip set with a direct-mapped and write-through cache-and-controller combination. One parallel and two serial ports

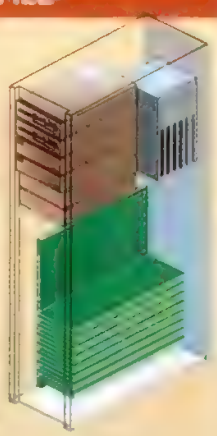
Mega Impact 486/50E, $4,450

are integrated onto the motherboard, and there is a socket for a Weitek coprocessor.

A BusTek BT-742A hard disk controller regulated the 340MB 14-millisecond Micropolis hard disk and filled one of the motherboard's eight slots; an Actix GraphicsEngine video adapter with 1MB of video RAM, and an S3 GUI accelerator filled the other. The 14-inch monitor, also from Mega Computer Systems, has a vertical refresh rate of 72 Hz at a 1,024-by-768 noninterlaced resolution.

The Impact ranked among the top machines on our processor test, even though it uses a 256K write-through cache instead of the potentially faster write-back cache. It also performed above-

FACT FILE



Mega Impact 486/50E
Mega Computer Systems, 10840 Thornmint Rd., San Diego CA 92127; 800-338-6628, 619-487-8888, fax, 619-485-1518.
List price (tested configuration): $4,450.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Micropolis 14-ms. 340MB SCSI hard disk, BusTek controller, 1.2MB and 1.44MB floppy disk drives.
Display: Actix 1,024-by-768 adapter with 1MB RAM, Mega 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, AMI ROM BIOS setup utility, BusTek SCSI driver, Actix graphics drivers.

CIRCLE 500 ON READER SERVICE CARD

PC LABS' BENCHMARK RELEASE 6.0

Mega Impact 486/50E

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	521	438	532	514
Memory	9,102	4,283	9,903	8,017
Disk	98	81	1,976	352
Video	1,424	1,360	4,417	2,605
WINBENCH	10,815	1,985	12,428	6,087

In Short: The $4,450 EISA-based Mega Impact 486/50E did well on our processor, memory, and WINBENCH graphics tests. Below-average performance on the video test is characteristic of the S3 GUI accelerator. Its hard disk performance was consistent with that of other noncached systems.

average on our memory test, helped by 60-nanosecond DRAM. Above-average performance on the WINBENCH test linked to below-average performance on our video test is characteristic of the S3 GUI accelerator. Its disk performance was comparable with that of other noncached hard disk systems.

The documentation is adequate and consists of separate manuals for the system board, BIOS, SCSI controller, and video adapter. Utility disks were included to configure the BIOS, supply drivers for the controller card and video adapter, and provide utilities. Although Mega installs *NetWare* on the machine, at present the company offers no on-site support for the package and has no certified Novell engineers on its staff.

The Mega Impact 486/50E comes with a one-year warranty on parts and labor. The company is negotiating for on-site service but does not provide it yet. Repairs are handled either by the manufacturer or through Mega's dealers, which number about 400 nationwide. Technical support is available on an 800 line weekdays from 8:30 to 5:30 P.S.T.

NATIONAL MICRO SYSTEMS INC.

Flash 486-50C

by Margaret A. Piemonte

At $3,064 for our tested configuration, the ISA-based Flash 486-50C was the least expensive unit in this roundup. It performed adequately on our tests, and its ten drive bays and eight slots make for plenty of expansion room.

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FIFTH GENERATION SYSTEMS, INC

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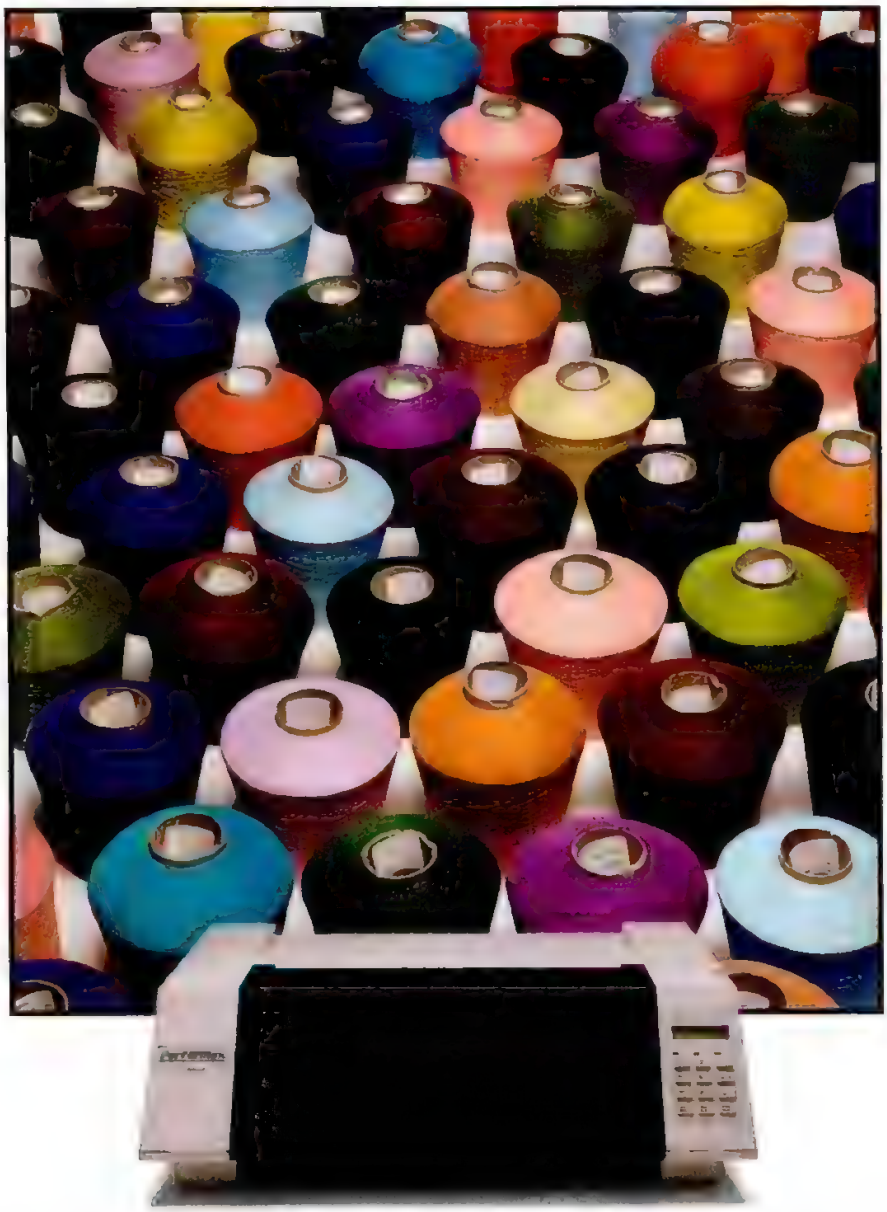

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CIRCLE 171 ON READER SERVICE CARD

Flash 486-50C, $3,064

The Flash 486-50C came with 8MB of RAM, a 256K cache, and a 340MB IDE hard disk. A standard tower measuring 25 by 7 by 16 inches, the Flash 486-50C holds ten drive bays: five accessible and five internal. The 275-watt power supply, however, has only five connectors, necessitating the use of Y splitters.

The motherboard, made by Advanced Integrated Research (AIR), has an AMI BIOS and a chip set from Chips and Technologies and United Microelectronics Corp. (UMC). It also contains 256K of 15-nanosecond direct-mapped write-back SRAM cache. The motherboard's eight SIMM sockets can accept up to 32MB of RAM, but you can add another 32MB using a proprietary memory card. Three of the motherboard's seven 16-bit slots are occupied, but the proprietary 32-bit slot (for the memory card) can also accept an 8- or 16-bit board.

The Flash 486-50C came with a 15-millisecond Maxtor IDE hard disk, which is connected to a multifunctional 8-bit paddle card that also holds the parallel port and one of the two serial ports. For $400 more you can get a Maxtor 430MB hard disk and for $600 more their 600MB unit.

The video display subsystem consists of a 1MB VGA 16 Turbo adapter from Pixel Engineering that can display 256 simultaneous colors at 1,024-by-768 resolution at 60 Hz; for $100 more you can get either the Diamond SpeedSTAR board or the Orchid ProDesigner IIs. The Pixel Engineering adapter was paired with a TVM SuperSync 3 monitor whose highest noninterlaced resolution is 800 by 600 with a 60-Hz vertical refresh rate.

The Flash 486-50C placed in our top grouping on our processor test but did not do as well on our memory test; this might be because the upgradable motherboard is designed to support a range of processors from 486SX/20 to 486DX/50 and may have a memory implementation geared toward an average of these processor classes. Moreover, when used with a 486/50, the motherboard has two or more wait states.

The video result was above average, but its WINBENCH score suffered because the unit was tested against others that used graphics accelerator chips. Lack of a caching hard disk controller put the Flash 486-50C in the lower bracket in terms of its disk score, among other machines without disk caches.

National Micro Systems offers a warranty for 15 months on parts and 24 months on labor. GE Computer Service provides on-site service during the first year for $75 extra; no extended warranty is available. The monitor is under a separate one-year warranty from its vendor. Requests for standard service, on-site, and technical support can be made through the same 800 number, available weekdays from 9:00 to 5:30 E.S.T.

PC LABS' BENCHMARK RELEASE 6.0

Flash 486-50C

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	528	438	532	514
Memory	7,533	4,283	9,903	8,017
Disk	121	81	1,976	352
Video	3,579	1,360	4,417	2,605
WINBENCH	2,559	1,985	12,428	6,087

In Short: The $3,064 ISA-bus Flash 486-50C, from National Micro Systems, has the lowest price in our review. An excellent processor score was offset by slower memory performance, perhaps due to the motherboard design. The video result was above average, but the lack of a GUI accelerator slowed the computer in terms of WINBENCH graphics. Its disk performance also reflected the lack of a cache.

PCI SYSTEMS INC.

PCI 486-50C128

by Laura Cox

At PCI Systems, custom configuration is the name of the game. If you've set your sights on graphics, you will need a graphics accelerator. If you opt for server capacity instead, PCI sells a first-rate monochrome monitor for $120 less, and a configuration with a 1.4GB 13-millisecond Panther P1-17S SCSI hard disk goes for $2,995. Corporate and government users with intensive storage demands and greed for speed stand to gain the most from this company's multiunit prices.

In our tested configuration, the ISA-based PCI costs $4,995. The sturdy, dark gray 24- by 7.5- by 17-inch tower holds eight drive bays: four accessible and four internal. Our test unit came with 8MB of 60-nanosecond DRAM, a 340MB Maxtor hard disk, TEAC 1.2MB and 1.44MB floppy disk drives, and a 14-inch Ancer CM-1433 Super VGA MultiScan monitor

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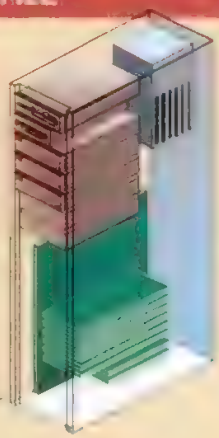

Flash 486-50C
National Micro Systems Inc., 2979-B Pacific Dr., Norcross, GA 30071, 800-642-7649; fax, 404-449-5297
List price (tested configuration): $3,064
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms. 340MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Pixel Engineering 1,024-by-768 adapter with 1MB RAM, TVM 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 501 ON READER SERVICE CARD

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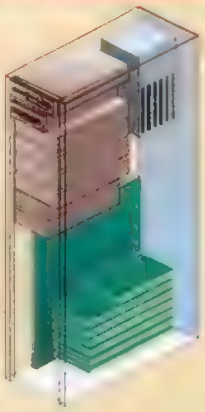

PCI 486-50C128
PCI Systems Inc., 5690 Sonoma Dr., Suite D, Pleasanton, CA 94566; 510-484-2818; fax, 510-484-3088.
List price (tested configuration): $4,995.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 128K cache.
Disk drives and controller: Maxtor 13-ms. 340MB IDE hard disk, GTK controller, 1.2MB and 1.44MB floppy disk drives.
Display: Tseng 1,024-by-768 adapter with 1MB RAM, Ancer Research 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 502 ON READER SERVICE CARD

PCI 486-50C128, $4,995

with a maximum noninterlaced resolution of 1,024 by 768 and a 72-Hz vertical refresh rate.

PCI uses the American-made Prosys Ideal 486 motherboard, with a Contaq chip set and an AMI BIOS. It has seven expansion slots: one 8-bit and six 16-bit. Like most systems in this review, the RAM cache is direct-mapped and write-back. A Tseng video card and a GTK disk controller filled two slots in our tested unit. The disk controller holds one parallel port, two serial ports, and a game port; the last port arrives disabled for corporate buyers.

Since the motherboard has no slots for memory expansion, 32MB of DRAM in 4MB SIMMs is the most you can expect. If you upgrade, you will have to dump the 1MB 60-ns. SIMMs that come standard for an 8MB configuration. But you can add a Weitek coprocessor and upgrade the processor RAM cache from 128K to 256K.

Though this unit turned in good processor performance, the PCI's memory score was quite low. As was the case with some other machines reviewed here, this discrepancy may have been due to an upgradable motherboard design geared to work with a range of processors. The Tseng Super VGA adapter produced a below-average score on PC Magazine Labs' video and WINBENCH tests. Its disk performance was comparable with that of other noncaching disk controllers.

When it comes to support, the PCI 486-50C128 comes with a generous two-year on-site service policy. Same-day service is provided by ComponentGuard, which has more than 3,000 locations nationwide. In addition, Compu-Answer offers 24-hour software support. You may also save some money by disregarding the service options, or you may extend the warranty for another year for an additional cost. PCI offers unlimited technical support to systems under warranty, weekdays from 7:30 to 5:00 P.S.T.; the call is not toll-free, however.

The Poly 486-50VF tied for first with the ATronics ATI 486B/50 on PC Magazine Labs' processor test and ranked second on the memory test.

PC LABS' BENCHMARK RELEASE 6.0

PCI 486-50C128

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	528	438	532	514
Memory	5,204	4,283	9,903	8,017
Disk	127	81	1,976	352
Video	1,454	1,360	4,417	2,605
WINBENCH	2,408	1,985	12,428	6,087

In Short: The $4,995 ISA-based PCI 486-50C128 yielded excellent processor performance but a slow memory score. Its disk performance was average for a noncached system; the PCI's video performance on the video and WINBENCH tests was below average. PCI has an above-average service policy and offers discounts for volume buyers.

POLYWELL COMPUTERS INC.
Poly 486-50VF
by Mario Baldasserini

Good performance, good components, and a good price mark the ISA-based Poly 486-50VF. This ISA tower has eight drive bays, a caching disk controller, a graphics accelerator, and plenty of power.

Our $4,500 test unit came with 8MB of RAM, a 256K cache, and a 340MB hard disk. The Poly's InterComp motherboard had an AMI BIOS and an OPTi chip set with an OPTi cache controller. You can upgrade the RAM to 32MB, but you will have to replace its 1MB SIMMs with 4MB modules.

Poly 486-50VF, $4,500

Also on the motherboard are eight 16-bit ISA slots, three of which held the video controller, I/O card, and hard disk controller. The last two slots, located toward the top of the tower, are too close to a large heat sink to accept full-length boards. Four of the eight drive bays are accessible 5.25-inch half-heights. Two internal bays are 5.25-inch half-heights, and two hold 3.5-inch drives.

The video subsystem in our test unit was based on a Portacomp Eclipse II GUI accelerator board with 1MB of VRAM and an S3 graphics accelerator chip. The ADI Microscan 3E low-radiation monitor, capable of 256 simultaneous colors, has a 72-Hz vertical refresh rate at a maximum noninterlaced resolution of 1,024 by 768. The UltraStor Ultra 15C IDE caching disk controller, with a 512K cache expandable to 8MB, drove a 340MB

PC LABS' BENCHMARK RELEASE 6.0

Poly 486-50VF

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	532	438	532	514
Memory	9,549	4,283	9,903	8,017
Disk	130	81	1,976	352
Video	2,027	1,360	4,417	2,605
WINBENCH	11,760	1,985	12,428	6,087

In Short: On our processor and memory tests, the $4,500 ISA-bus Poly 486-50VF tied for first place and ranked second, respectively, among all the machines tested. It placed third on the WINBENCH graphics test, but its S3 GUI accelerator was characteristically slow in terms of DOS video. The disk cache is expandable to 8MB, but the 512K in our test unit earned it a slow disk score.

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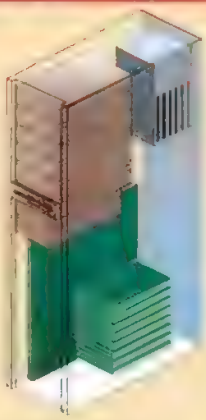

Poly 486-50VF
Polywell Computers Inc., 61C Airport Blvd., South San Francisco, CA 94080, 800-999-1278, 415-583-7222, fax 415-583-1974
List price (tested configuration): $4,500
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms. 340MB IDE hard disk, UltraStor controller, 512K cache, 1.2MB and 1.44MB floppy disk drives.
Display: Portacomp 1,024-by-768 adapter with 1MB RAM, ADI 14-inch monitor, 72-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.0.

CIRCLE 503 ON READER SERVICE CARD

15-millisecond Maxtor LXT340A hard disk.

The Poly ranked among the top machines on our processor test and also scored well above average on our memory test, thanks to its 60-nanosecond RAM and an efficient processor-to-memory implementation. As it did in every other system that had it, the S3 GUI accelerator yielded top-notch performance on our WINBENCH test and below-average performance on the video test.

Although the Poly 486-50VF's hard disk cache is expandable to 8MB, our test unit had only 512K. Competing against machines with larger cache sizes, it turned in a poorer score on the disk test.

Polywell Computers' impressive warranty covers two years on parts and offers five years of in-house labor. The company estimates the repair response time at 24 hours after arrival and absorbs the cost of return shipping. On-site service from Repair Technologies applies to Canada and costs $75 the first year. You can extend it for another year for $175. Toll-free technical support hours are Monday through Friday from 8:30 to 5:30 P.S.T. and Saturdays from 1:00 to 6:00. Polywell also installs and configures Novell's *NetWare*, Version 3.11, for up to 250 users; the company also sells Ethernet and Token-Ring adapters. On-site service for a *NetWare* network costs an extra $250 above the $75 for regular on-site service.

SILICON VALLEY COMPUTER

SVC 450DXC I2-510

by Carolyn Falconer

The $3,650 ISA-bus SVC 450DXC I2-510, from Silicon Valley Computer, is an all-around bargain in a compact tower case. With the second-lowest price in this review, the SVC may seem attractive, but the performance of the configuration PC Magazine Labs tested does not measure up to that of more robustly configured systems.

The machine, which came to PC Labs with 8MB of RAM, a 64K cache, and a 510MB hard disk, is distinguished by its diminutive stature. (A 300MB unit was not available at the time of this review, but the company sells a system with a Conner 360MB IDE disk for $100 less than the 510MB model.) At only 18.5 by 15.5 by 6.5 inches, it is the smallest standard tower in our review. Despite its small size, it can house as many as six drives: three front-accessible 5.25-inch and two 3.5-inch slimlines, as well as one internal 3.5-inch drive.

Silicon Valley uses an OPTi chip set but puts its own BIOS on its own motherboard, a six-layer model that the company designed and manufactured in the United States. The motherboard has eight 16-bit ISA expansion slots, two of which are occupied by the video and the disk controller cards. One slot also has an extension, which lets it accept a 32-bit memory card.

You can install a Weitek coprocessor on the board. Eight SIMM sockets on the motherboard accept either 1MB or 4MB modules for a maximum memory capacity of 32MB on the motherboard itself. A proprietary 32-bit memory expansion card can house 32MB additional RAM for a total of 64MB. (Using the standard eight 1MB modules, the maximum RAM capacity becomes 40MB.)

SVC 450DXC I2-510, $3,650

PC LABS' BENCHMARK RELEASE 6.0

SVC 450DXC I2-510

Test Scores		Systems in this review: Worst	Best	Average
Processor	477	438	532	514
Memory	8,386	4,283	9,903	8,017
Disk	170	81	1,976	352
Video	1,886	1,360	4,417	2,605
WINBENCH	2,207	1,985	12,428	6,087

In Short: For only $3,650, the ISA-based SVC 450DXC I2-510 includes a 510MB 12-ms. Conner hard disk that ranked first out of the eight noncached systems. Its memory score was above average, but the small 64K RAM cache held it back in terms of processor performance. Its video and WINBENCH scores were both below average.

The 510MB Conner IDE hard disk found in our tested unit has a 12-millisecond access time and uses a conventional Silicon Valley multifunction controller card. This card has built-in parallel and serial ports, which can be disabled by jumpers. Silicon Valley will configure your machine with drive arrays or tape backup units upon request.

The video subsystem uses the Trident TVGA Super 8900 video card with the

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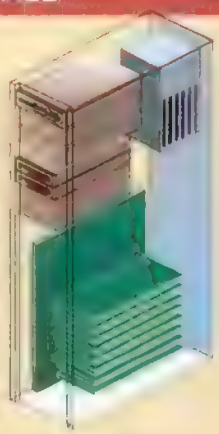

SVC 450DXC I2-510
Silicon Valley Computer, 441 N. Whisman Rd., #13, Mountain View, CA 94043, 415-967-1100, fax, 415-967-0770
List price (tested configuration): $3,650
Memory and processor RAM cache: 8MB 70-ns. SIMMs, 64K cache
Disk drives and controller: Conner 12-ms. 510MB IDE hard disk, Silicon Valley controller, 1.2MB and 1.44MB floppy disk drives.
Display: Trident 1,024-by-768 adapter with 1MB RAM, IQ 14-inch monitor, 70-Hz refresh rate
Software: DOS 5.0; *QATest*, Version 4.21.

CIRCLE 504 ON READER SERVICE CARD

Quadtel video BIOS to run the IQ 214S Super VGA monitor. The monitor's highest noninterlaced resolution is 800 by 600 with a 70-Hz vertical refresh rate.

The SVC ranked below average on our processor test and average on our memory test; 70-nanosecond RAM coupled with only 64K of direct-mapped, write-back cache is probably the culprit. The machine also scored below average on the video test and the WINBENCH test. Although the hard disk ranked on the low side of average on our disk test, it outperformed the seven other systems with uncached disk subsystems—probably due to the Conner unit's 12-millisecond access time.

The SVC 450DXC I2-510 offers a one-year warranty on parts and labor. Extended and on-site service are available for an additional cost. Service is provided by Computer Service Network, and technical support is available through dealers only.

SIRIUS SYSTEMS TECHNOLOGY INC.

SST 486-50MWC

by Margaret A. Piemonte

The competitively priced, ISA-bus SST 486-50MWC is a small-footprint desktop PC that comes with a SCSI-2 interface. The $3,850 unit Sirius Systems Technology sent to PC Magazine Labs for testing contained 8MB of RAM, a 256K cache, and a 340MB SCSI-2 hard disk. The system's compact case nevertheless can hold five drives—all of which can be reached from the front of the case.

SST 486-50MWC, $3,850

The system's TMC Research motherboard uses an AMI BIOS and an OPTi chip set. With a proprietary 32-bit memory board, the machine could handle up to 64MB RAM. An OPTi 82C493 cache controller regulates the direct-mapped, write-back processor RAM cache.

Of the eight ISA slots on the motherboard (six 16-bit, one 8-bit, and one proprietary 32-bit), five were empty in the tested system. One 16-bit slot cannot accept a full-length board because the drive bays block it. The 340MB hard disk and the 1.2MB and 1.44MB floppy disk drives filled three of our tested unit's five drive bays. The parallel port and the game port share the 8-bit I/O card with two serial ports that are attached via cables but do not take up any slots. There is also a mouse port on the video board.

Using an S3 GUI accelerator, the SST 486-50MWC had the highest score on PC Magazine Labs' WINBENCH test.

The 340MB 15-millisecond-rated Micropolis 1684-7 hard disk uses the SCSI-2 interface and an UltraStor Ultra 14F hard/floppy disk controller. For $415 more, Micropolis offers a 676MB hard disk, and for $1,200 more you can get a 1.2GB unit.

The SST's video subsystem, aimed at Microsoft Windows users, uses the STB Wind/X Super VGA video adapter, which has an S3 chip set and 1MB of video RAM. The CTX 14-inch monitor displays 1,024-by-768 noninterlaced resolution at a 72-Hz vertical refresh rate. For $830 more, you can get an Idek MF-5217 17-inch flat-screen monitor.

The machine proved a solid performer on all of PC Labs' benchmark tests. It yielded above-average processor and memory scores, which may be attributed to the external processor RAM cache architecture and the OPTi cache controller. As did other machines that had the S3 GUI accelerator, it ranked above average (first, in fact) on our WINBENCH test and below average on the video test. The SCSI-2 Micropolis hard disk placed slightly below average but came in above average when compared with other uncached disk subsystems.

The company offers a one-year warranty on parts and labor that includes on-site service by Idea ServCom; you can extend it a second year for 10 percent of the system price. Service is obtained by calling SST's toll-free number weekdays from 7:00 to 6:00 C.S.T. and Saturdays from 8:00 to 5:00. Once the problem is diagnosed, Idea ServCom dispatches service representatives from one of its 200 locations nationwide. Idea ServCom estimates response time at about 2 hours but guarantees service in 8 hours. ■

PC LABS' BENCHMARK RELEASE 6.0

SST 486-50MWC

Test Scores		Systems in this review		
		Worst	Best	Average
Processor	531	438	532	514
Memory	8,882	4,283	9,903	8,017
Disk	136	81	1,976	352
Video	1,659	1,360	4,417	2,605
WINBENCH	12,428	1,985	12,428	6,087

In Short: An ISA desktop, the $3,850 SST 486-50MWC placed first on our WINBENCH test, though its S3 GUI accelerator ranked below average on the video test. One of two systems with a SCSI-2 interface, the unit had a disk score consistent with those of other noncached systems. Its processor and memory scores were well above average.

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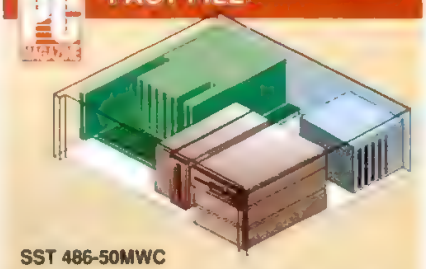

SST 486-50MWC
Sirius Systems Technology Inc., 4344 Young St., Pasadena, TX 77504; 800-424-0724, 713-946-0724; fax, 713-946-5451.
List price (tested configuration): $3,850.
Memory and processor RAM cache: 8MB 60-ns. SIMMs, 256K cache.
Disk drives and controller: Micropolis 15-ms. 340MB SCSI-II hard disk, UltraStor controller, 1.2MB and 1.44MB floppy disk drives.
Display: STB 1,024-by-768 adapter with 1MB RAM, CTX 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.0, *Cache86, PreCursor, Tree86.*

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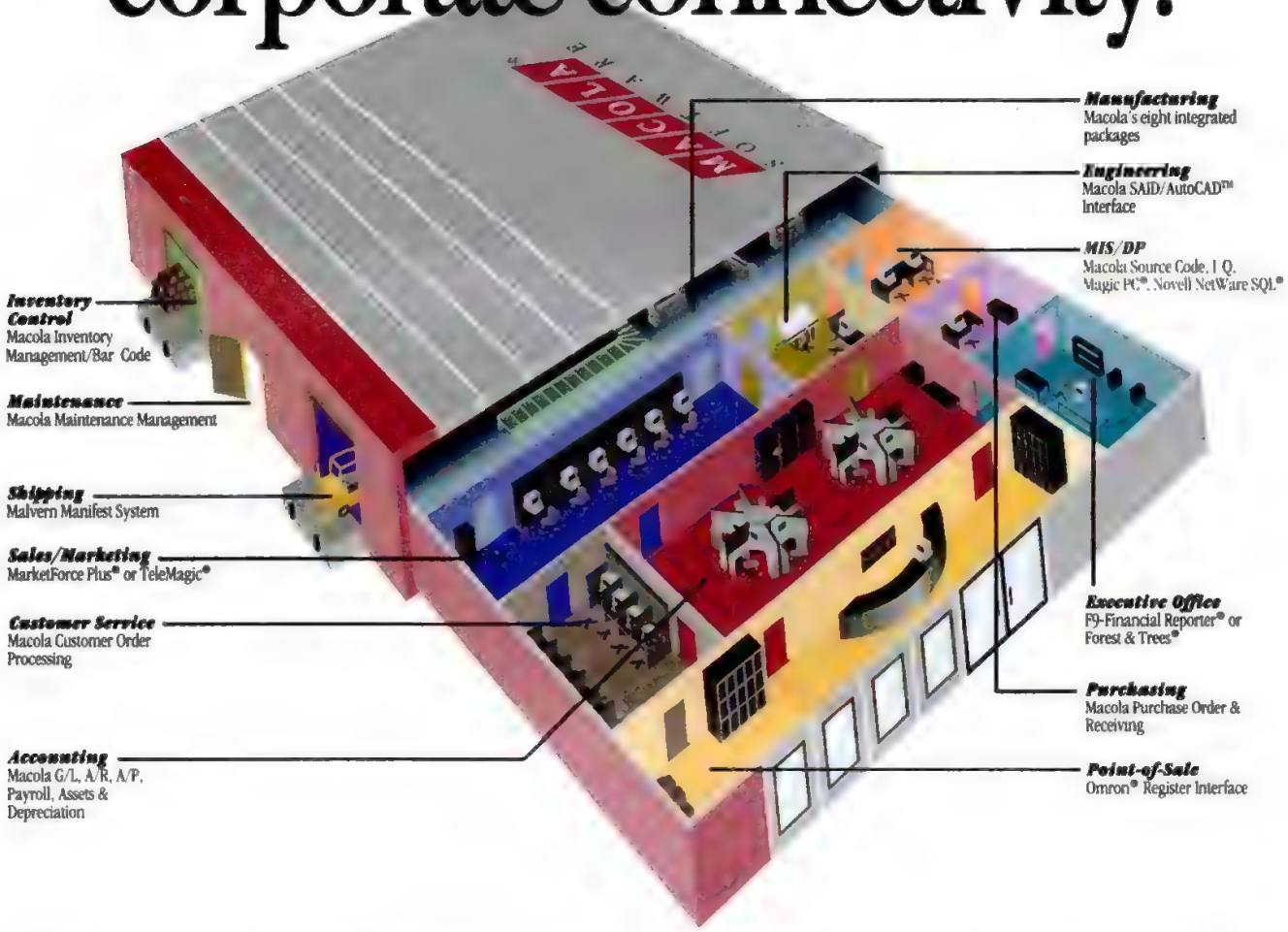

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THE VISUAL DEVELOPMENT ENVIRONMENT

More than Just a Pretty Face?

Graphical and interactive environments spell end-user relief but place an extraordinary burden on applications developers. The eight visual development environments (VDEs) reviewed here offer an interactive approach to interface design and hide the uglier aspects of the Windows application program interface (API). The result is prettier programs, but can these VDEs tackle the big jobs?

by Charles Petzold

PHOTOGRAPHY: THOM O'CONNOR

There is no such thing as a free lunch. As the trend in PC software has headed toward the visual and highly interactive Windows environment, designers and developers are more burdened than ever to create compatible applications.

In the old days, the only way to develop programs on the PC was to run compilers or Make files from the DOS command line. The compilers slurped up source code, crunched on it for a while, and then spit out machine code—essentially no different from the way people compiled programs on mainframe terminals 15 or 20 years ago.

Compiler vendors, in their continuing efforts to "build a better mousetrap," eventually introduced the integrated de-

velopment environment (IDE). First introduced on the PC with Borland's Turbo Pascal in 1983, the IDE typically combines an editor, a compiler, and (nowadays) a debugger in one integrated package. IDEs can quickly compile source code in memory and highlight syntax errors in the source code file.

The IDE was certainly an improvement, but end users' increasing demands for user-friendly interfaces soon created a new problem. Visually attractive bulletproof user interfaces are just plain hard to program. In the DOS world, this resulted in a spate of interface libraries. But even this wasn't enough. Programmers still had to specify coordinates for pull-down menus and figure everything out arithmetically. So vendors started bundling interface libraries with screen designers that let you design your windows and menus visually.

THE DEMAND FOR VISUAL PROGRAMMING

For a graphical environment such as Windows, some sort of visual designer is even more essential, since you're dealing with pixels rather than an 80- by 25-character grid. The first visual design tool for Windows was Microsoft's own dialog box editor, introduced in 1987. This let you position and size buttons (and other controls) within a dialog box. The editor generated resource script statements containing the dialog box template. Later tools generated skeleton Windows source code, which you could then modify and recompile.

The newest idea is to take a Windows-based IDE, combine it with an interface designer, and raise the level of integration and interaction up a couple of notches. We call the result the visual development environment, or VDE. The VDE makes Windows programming easier in two ways: It offers an interactive approach to interface design, and it hides the ugly aspects of the Windows API.

In concept, the VDE is a significant advance in program development. A great deal of the overhead and drudgery of creating a graphical environment—dialog boxes, pull-down and pop-up menus—is eliminated.

Keep in mind that these visual development tools are still in their infancy, regardless of how sophisticated and how attractive they may now appear. They are certainly not perfect and sometimes have severe limitations.

RATING THE PRODUCTS: SUITABILITY TO TASK

We tested visual development environments (VDEs) by creating two applications: a forms-based application linked to an underlying database, and an executive information system (EIS) that graphed spreadsheet results and combined animation and sophisticated text menus. Our Suitability to Task ratings deal with the parts of the process necessary to create these applications. None of the packages we looked at made application building trivial, although for the most part they did take the pain out of interface design.

Menu creation is critical for developing intuitive, user-friendly applications. We looked at the range of options for building menus. A competent package should allow the programmer to implement standard Windows pull-down menus or use buttons and graphics objects as menus. Better packages will allow multilevel pull-down menus with Windows-style graying for unselectable items.

Form creation refers to the ease with which programmers can build forms for entering and accessing data. Competent products will allow the assignation of special fields (currency, data, decimal, and so on) without special coding to explain their formats. More sophisticated packages support dynamic data exchange (DDE), as well as *dBASE* and *Paradox* data file formats.

The **user interface objects** are an integral part of a graphical user interface. The best packages offer a wide range of interface objects that can be easily customized to suit the application's needs. Objects should include buttons, scroll bars, bitmaps, radio buttons, check boxes, and other standard Windows features. Better packages will support object grouping and hypertext.

The program's **graphics handling** capabilities include its range of drawing tools (circles, arcs, lines, and so on), its graphing functions, and the ability to import bitmaps in various formats. Better packages will support animation and include clip art.

The program's facility for **text handling** is measured by the flexibility with which text may be used in text boxes. Competent products offer scrollable text boxes and some degree of formatting, as well as hot-word support. The better the product, the more options are available to control the appearance of text. In the top products, the text handling may extend to the appearance of text in the controls.

A product's **programming** and **debugging** facilities determine whether it can handle the requirements of complex Windows programs without limitation. A package with robust abilities will have a full-featured programming language that is extensible through DLLs. The debugger should include variable inspection and breakpoints. The very best products offer single-step tracing through programs.

SUITABILITY TO TASK: Product Name	
Menu creation	●●●●
Form creation	●●●○
User interface objects	●●○○
Graphics handling	●○○○
Text handling	N/A
Programming/debugging	●○○○

4—Excellent
3—Good
2—Satisfactory
1—Poor
N/A—Not applicable: The product does not perform this task.

THE MAKINGS OF A VDE

Nailing down the characteristics that define a visual development environment is not easy. When the editors and writers at *PC Magazine* first started discussing this project, most of us took the I-know-it-when-I-see-it approach. Of course, that's not quite adequate when choosing a group of products to review! Here are the criteria on which we finally agreed:

First and foremost, VDEs should let developers create Windows interfaces easily and without resorting to the Windows API. But VDEs should also offer a method to access the Windows API if a programmer wishes to use it. VDEs should

A GUIDE TO MICROSOFT VISUAL BASIC ADD-ON CONTROLS

by Barry Simon

While many visual development environments are extensible through their ability to make DLL (dynamic link library) calls, Microsoft Visual Basic can also add buttons, or controls, to the Visual Basic toolbox through special DLLs. With these controls, you can draw new objects on your Visual Basic forms and change their properties or program them just as you'd manipulate the built-in objects.

Two huge collections of controls are available: MicroHelp's VBTools 2.0 (Roswell, Georgia; 404-594-1185; $189) and Microsoft's Professional Toolkit for Visual Basic (Redmond, Washington; 800-426-9400 or 206-882-8080; sold separately for $299 or bundled with Visual Basic for $495). Many single-purpose or smaller collections are also available.

The beta version of VBTools that we saw added more than 30 controls to the 15 that come with Visual Basic. Several of these are enhanced versions of the Visual Basic controls, most notably a directory list that will display and sort on name, size, attribute, or date, and a debugging tool called Property Manager.

VBTools also includes slide, gauge, and spin controls, alarms, digital and analog clocks, and several enhanced list boxes, including one that looks like a spreadsheet and one that allows mixing pictures and text. It has effortless MDI: Just draw your MDI windows and they become child windows of the form you place them on and have the usual MDI abilities.

Available just as we went to press, Microsoft's Professional Toolkit for Visual Basic is a collection of controls that significantly enhances the Visual Basic environment. It provides 22 additional controls, including special ones for Pen Windows and for the Multimedia Extensions. Some of these are just the best of the third-party controls licensed from their respective vendors. Among the simplest are the six from Sheridan Software Systems' 3D Widgets collection, MicroHelp's Gauge and Shift State controls, a subset of Desaware's Custom Control Factory, enhanced scroll bars from Crescent Software, a Spin control from Outrider Systems' EditTool, and graphing controls from Pinnacle Publishing's Chart Builder.

Also included in Professional Toolkit are controls that set up MDI windows and allow embedded OLE objects. There's also a link to COMMDLG. This is a DLL that is part of Windows 3.1 and can be shipped to Windows 3.0 users. With this control you can easily pop up the standard file open, file save, color and font selectors, and printer dialog boxes.

Sheridan Software Systems has a $109 collection of 12 controls called 3D Widgets (Melville, New York; 516-753-0985). These include not only 3-D versions of the standard Visual Basic controls but even 3-D menus, where the selection bar has a raised look. The company offers three subsets of the full 3D Widgets at lower prices.

Sheridan Software has announced an integrated development tool called VBAssist, which promises to reduce the amount of keyboarding needed in the Visual Basic environment. VBAssist allows the programmer to use the mouse to set tabs and add fields to a control array. It uses the same visual metaphor that Visual Basic uses. A code library is also included.

Crescent Software's $199 QuickPak Professional for Windows (Ridgefield, Connecticut; 203-438-5300) is a collection of hundreds of useful canned routines for your Visual Basic programs and includes 12 controls. Six provide masked input for currency, date, time, text, integer, and long integer. Among the other controls is an enhanced list box, which can be put into a window and resized.

For $48, Desaware's Custom Control Factory (San Jose, California; 408-377-4770) has a single control that provides animated and multistate buttons. Outrider Systems (Houston, Texas; 713-521-0486) has ButtonTool and EditTool ($89.95 together), enhanced button and edit controls that include 3-D and shadow effects. The company also expects to have released VBaseTool, an enhanced picture tool, and a HelpTool by the time this article appears.

Pinnacle Publishing's $149 Chart Builder for Visual Basic (Kent, Washington; 206-251-1900) adds a single control, but that control will show a chart in one of 11 types, including 2-D and 3-D bars and pie, scatter, polar, and hi-lo-close charts.

ImageSoft (Port Washington, New York; 516-767-2233) sells a $299 bundle of ObjectTrieve/VB, a database manager for Visual Basic, and DbControls, two controls that allow the easy definition and operation of ObjectTrieve databases.

Data Techniques' ImageMan/VB (Savannah, Georgia; 912-651-8003), a $249 package we only saw in beta, will provide a display of 24-bit color TIFF, .PCX, .GIF, .BMP, .DIB, .WMF, and EPS files in its control.

If you use Wall Data's Rumba to connect to IBM 3270 or AS-400 computers from your PC, you'll be interested in Rumba Tools for Visual Basic (Redmond, Washington; 206-883-4777; $195), which lets you use Visual Basic to build a Windows interface to the host computer quickly. (There is also a ToolBook version.) A coupon for a free evaluation copy of Rumba and Tools for Visual Basic is included with Professional Toolkit. ■

optimally offer full-featured programming. This is where VDEs exceed the abilities of simpler scripting languages and authoring tools. An interface to dynamic link libraries (DLLs) should also be included.

Second, we restricted our survey to fully integrated one-stop solutions for Windows programming. Interface builders such as Blue Sky's WindowsMaker or CASE tools that generate code requiring a separate compiler do not meet this criterion.

Third, we wanted to examine products that clearly transcend the IDE. Like the IDE, the VDE is a fully integrated programming environment. Where the VDE goes beyond the IDE is in the visual construction of user interface objects, and in providing an interactive link between these objects and code.

For example, in Microsoft Visual Basic, you first build a window containing buttons and other user interface objects. You can then define various characteristics of these objects.

Double-clicking on any of the objects invokes a text window into which you can enter code that is run when the user triggers the object in some way. You don't need to identify user interface objects using numbers or names. (For a closeup of Visual Basic, be sure to read the Lab Notes column in this issue.)

Although several Windows-based IDEs are currently available (Borland's Applications Frameworks is one example), those packages do not offer this type of interactive design. Even if they include an interface designer, their capabilities are not as fully integrated as in the VDE packages.

Lastly, although database packages that include interactive forms builders such as PowerSoft Corp.'s PowerBuilder (see Toolkits, January 29, 1992) may resemble VDEs in many ways, we decided not to include them in this roundup since they have special features that would require us to evaluate them differently. This roundup is dedicated to general-purpose VDEs.

THE VDE POTENTIAL: GFA BASIC for Windows

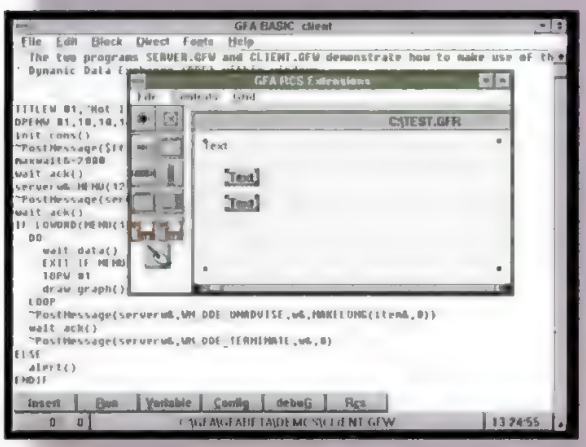
by Paul Bonner

If *PC Magazine* gave out Editors' Choice awards for potential, GFA BASIC would be a sure winner. This 32-bit compiler promises to give BASIC users the kind of Windows programming power that has previously been the exclusive domain of C programmers.

GFA BASIC's internal command set is huge, consisting of more than 700 commands and functions. To some extent this is due to the procedural nature of GFA BASIC. In an event-driven VDE, the menu-generating code is part of a DLL (dynamic link library) or part of the runtime environment. But in GFA BASIC, the language itself contains the commands to create and manipulate menus and other interface objects.

The size of GFA BASIC's command set also testifies to the richness of the language and the breadth of choices it offers the programmer. GFA BASIC provides comprehensive support for line drawing, BitBlt graphics, matrix arithmetic, string manipulation, bitwise operations, and database access. With GFA BASIC you can link to Borland's *Paradox* engine or manipulate *dBASE* files. It also offers the programmer more control than any other BASIC dialect over the appearance and behavior of windows, menus, and other user interface elements.

GFA BASIC is extensible, which means that you can call any DLL, including Visual Basic add-ons, custom DLLs written in a language such as C, or the Windows API. But if you need to call the Windows API, you'll want to use GFA BASIC's own built-in functions to do so. Because it supports pointers, you can make Windows API calls using the simple syntax and structure of BASIC without having to declare each Windows function as an external routine.



The improved resource construction set (RCS) in Version 4.10 of GFA BASIC for Windows will save dialog box definitions in a special resource file format that can be loaded back into the RCS and edited without affecting your other program code.

Its language features and open architecture, combined with its impressive execution speed, make GFA Basic a far more powerful development tool than either Microsoft Visual BASIC or Realizer. It's a more portable tool, also. All but a few Windows-specific calls written in GFA BASIC for Windows can be ported without modification to GFA BASIC for DOS. This lets you create a DOS application in either text or graphics mode, complete with multiple windows, menus, scroll bars, and minimize buttons.

GFA BASIC's development environment is not as user-friendly as a true VDE, so if your proposed application is simple, you will probably find it easier to use another product. But if your program is sophisticated, the power of the GFA BASIC dialect may well result in significant time savings, despite its development environment.

GFA BASIC is a complex product. There are three ways that it could counterbalance the complexity: excellent documentation, a highly integrated development environment, and strong visual design tools. Unfortunately, the first release of the product had none of those. Instead, it supplied a poorly designed program editor, abysmal documentation, and an amateurish screen design tool.

As we were going to press, how-

NO TWO THE SAME

The VDEs reviewed here are often as different from each other as they are from more conventional programming tools. Some, like Visual Basic, require a lot of support code; others, like ToolBook, let you create links between objects visually rather than through program code; still others, like ObjectVision, don't require coding at all.

All of the packages provide tools for interactively designing the graphical user interface. To bring the interface to life, some use a standard programming language such as Basic or C, others a proprietary scripting language such as ToolBook's ObjectScript. Some, like Visual Basic, have full debugging environments; others, such as ObjectVision, have no debuggers at all.

Distributing the application also differs from one VDE to another. Visual Basic and Realizer produce a standalone executable file; all the other VDEs require runtime modules, sometimes involving a distribution fee.

VDEs are generally based on an event-driven model like Windows itself. In event-driven VDEs, the application does not exist in a single place. Instead, there are fragments of mini-procedures scattered throughout the user interface—a rather revolutionary method.

One product in our roundup that is not technically event-driven is Realizer. However, since Realizer lets you design the interface in an interactive fashion, and because its programming language is so rich, we have included it and even given it an honorable mention.

Another product that has a rich programming language, GFA BASIC, had only limited visual design tools at the time we went to press, but we did get to examine an early beta version of the new visual design tools. A summary of GFA BASIC is included as a sidebar. Finally, we took a look at Bell Atlantic's *Thinx*. While *Thinx* is not a full-featured VDE, its unique use of graphical objects merits discussion (also in a sidebar).

THE USER-CENTRIC FOCUS

It's unlikely that any of the VDEs discussed here will be used for large general-purpose commercial applications. They may fall short in execution speed and often are not flexible enough to handle the demands of complicated applications. They are better suited for in-house corporate programming and prototyping. Ultimately, however, perhaps the most important impact of the VDE will be the design and creation of better Windows programs.

Windows and other graphical interfaces have changed the way we think about the user interface. Rather than the screen being used to echo what the user types in, the screen itself becomes a source of user input. A Windows application often displays a variety of user interface objects, such as buttons, scroll bars, and menus, which make the program more visual and easier to use.

Alas, programmers are often not very good about putting themselves in the user's mind-set. Many would prefer to code complex algorithms than to design a dialog box or a menu. Thus, the user interface is often given short shrift.

The VDE changes that focus in a surprisingly autocratic manner. Many VDEs require you to design the user interface first. Only after you've placed a button on your window can you begin writing the code that the program executes when the button is pressed.

The VDE also helps by putting the programmer smack-dab in the middle of Windows to take advantage of the sophisticated interaction that Windows allows. This can inspire the programmer to create user-centric programs that are highly visual, easy to use, and even fun.

---

ever, the folks at GFA Software Technologies literally showed up at our door with a beta version of the new GFA BASIC for Windows—Version 4.1.3—which will have been released by the time you read this. In addition to adding direct language support for the new features in the Windows 3.1 API, Version 4.1.3 includes a new program editor complete with a strong interactive debugger, and a new resource construction set (RCS) for designing dialog boxes. In addition, the company is rewriting the documentation. The new version will also provide a comprehensive written tutorial—something sorely lacking in the current version.

The revised program editor provides on-line help, access to any Windows font, and better support for standard Windows editing conventions than the current version. Its new debugger lets you step through, trace, or set breakpoints anywhere in your application, and can provide a constant readout of the current values of up to seven variables.

The new RCS lets you specify the attributes of each control in a dialog box and then save the design in a special binary resource file that is called by your program. This lets you load the resource file back into the RCS and edit it even after you've started to write code utilizing the resource. GFA BASIC, Version 4.1.3, is not as smooth as a VDE, nor does it supply the same level of linkage between user interface elements and code, but for a procedural-based development system it's an adequate solution.

GFA BASIC is never going to be as easy to use as a true VDE, but the changes in the new version elevate it from a product that we could recommend only if you don't mind an ultra-steep learning curve to one that we would recommend to anyone who is willing to pay the price of a little more complexity in return for a richer, more flexible, and more powerful programming environment. ■

GFA BASIC for Windows, Version 4.1.3
GFA Software Technologies Inc., 27 Congress St., Salem, MA 01970; 800-766-6432, 508-744-0201.
List Price: $295.
Requires: 1MB RAM, Microsoft Windows 3.0 or later, DOS 3.0 or later.
In Short: GFA BASIC is a powerhouse Windows development environment that to date has been sabotaged by poor documentation and developers' tools. Version 4.1.3, with new documentation, a comprehensive tutorial, and much-improved program and resource editors, should unleash the power of this sleeping tiger.
CIRCLE 513 ON READER SERVICE CARD

HOW WE TESTED

To test the capabilities of the VDEs reviewed here, we devised two tasks. Prototypes were written in C with the Windows SDK (Software Development Kit), and each reviewer was asked to duplicate the functionality using the VDE.

The first prototype, shown in Figure 1, is a forms entry program that saves and retrieves records in a flat-file database. Buttons at the bottom of the window save records, move among the records in the database, delete records, and switch between entry mode and viewer mode. A sales tax calculation is based on ZIP code.

The second sample program, shown in Figure 2, is a simple executive information system (EIS) that includes a dialog box to open files and retrieve data for any of ten years of monthly revenues and expenses, or for the ten years in total. The program calculates a profit and displays the items in a bar graph, pie chart, or text format. Whenever profits are displayed, a small bitmapped figure in the lower right corner of the window waves his arms in joy.

Figure 1: The data entry form application is a simple flat-file database.

If VDEs are to be used to create production-quality applications rather than just in-house utilities and prototypes, then applications created with them must execute as quickly as those created by traditional means (or nearly). Intuitively, we would expect that VDE applications would run slower. In these reviews, performance was not formally measured because each of these packages develops applications idiosyncratically.

Originally we set out to compare the execution speed in each product's im-

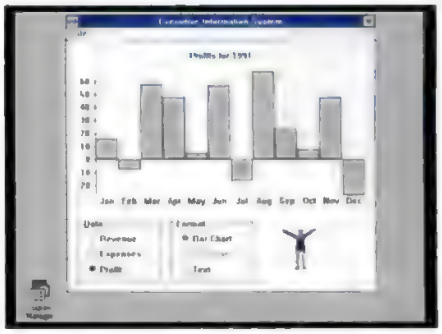


Figure 2: This executive information system (EIS) application is somewhat complex and challenged our packages.

EDITORS' CHOICE

- **Microsoft Visual Basic**
- **ToolBook**

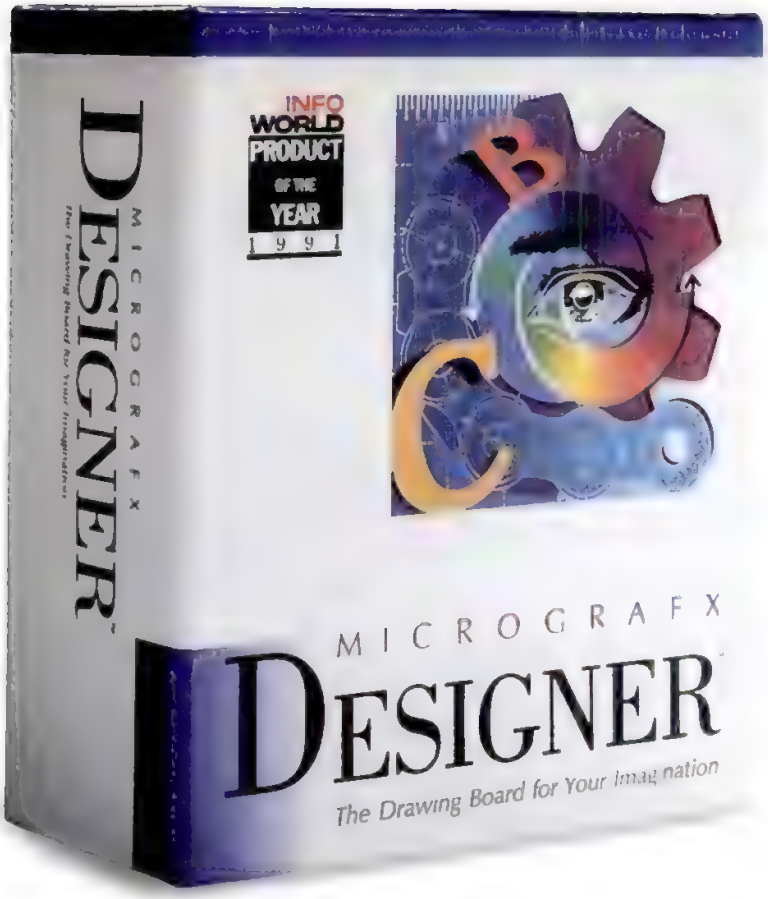
Visual development environments, or VDEs, let programmers using non-object-oriented languages in a structured style under DOS create object-oriented, event-driven Windows applications without forcing them to learn the event-driven, object-oriented paradigm. The hard parts—encapsulation, event handling, the Windows API—are all taken care of by the VDEs. But what's left—coding the logic behind the interface objects and events—can become much more difficult if the VDE gets in the way.

In this roundup we looked for VDEs that struck the perfect balance between ease of use and programming power. Of all of them, Microsoft Visual Basic offers the most power and flexibility while making interface design so easy it's fun—and all for a strikingly low price. While Visual Basic is missing some of the built-in functions found in other VDEs (such as hypertext and database support), its full-featured programming language and open architecture more than compensate. In addition, Visual Basic and Realizer are the only products in our roundup that can be executed without a runtime module; they compile to an .EXE that can be run directly under Windows as long as you have the (royalty-free) dynamic link library (DLL). For all these reasons, Visual Basic earns our Editors' Choice award.

With Visual Basic, it is necessary to write program code to achieve anything beyond a pretty but nonfunctional user interface. Asymetrix Corp.'s ToolBook is a different kind of VDE, but one that is powerful and elegant in its own right. Though lacking some of Visual Basic's power, ToolBook lets you create useful applications with only minimal programming. ToolBook's screen design tools are rich and easy to use, as you can see in our Suitability to Task scores. And though it costs more than Visual Basic, ToolBook has superior text-handling features, including hypertext support. Finally, like Visual Basic, ToolBook has an open architecture that has encouraged third-party add-on products. With its speed problems now solved, ToolBook definitely deserves an Editors' Choice award and is the preferable solution when you are building hypertext applications.

A hearty honorable mention goes to Within Technologies' Realizer. Realizer's screen design tools are not as highly evolved as one might like, and it is more procedural than Visual Basic, but the extended support for user interface elements (spreadsheet-like grids, animation, charting, and event scheduling) and its high-level language support for communications and print routines make developing Windows applications, especially general business applications, a speedy and elegant process.

VDEs cannot be judged strictly by the features they include; ease of use is all-important. Visual Basic, Toolbook, and Realizer succeed admirably in making their rich feature sets accessible to developers.



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CIRCLE 361 ON READER SERVICE CARD

They came
We con

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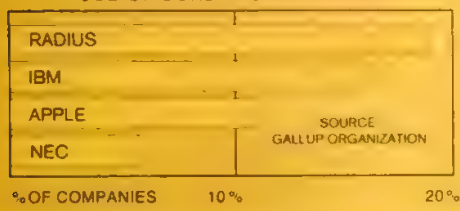
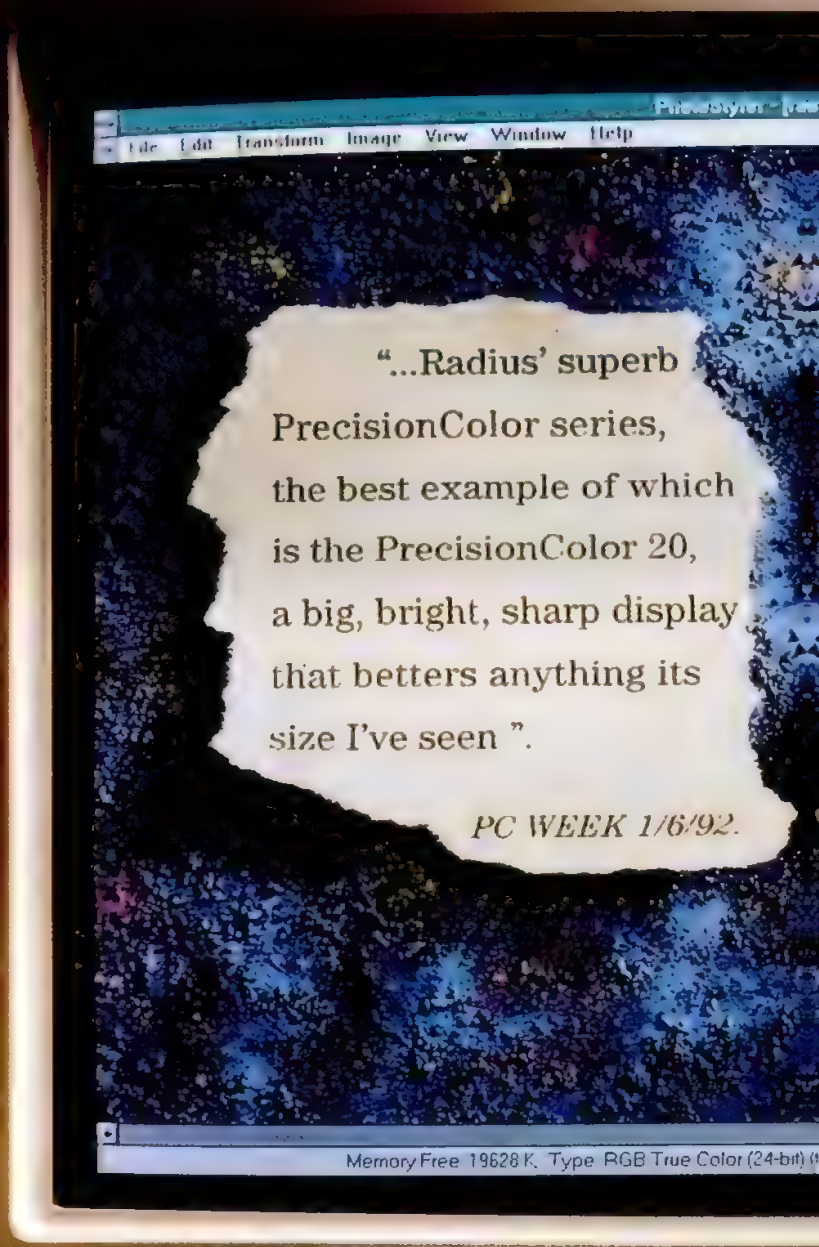


evaluations, with the most demanding standards, the PCD/20 has won hands down every time. But even more important are the productivity gains. "With the PCD/20, I can view three mainframe sessions at once, do a letter and still manage my calendar program," said one client at a major accounting firm. "I sit in front of my monitor for



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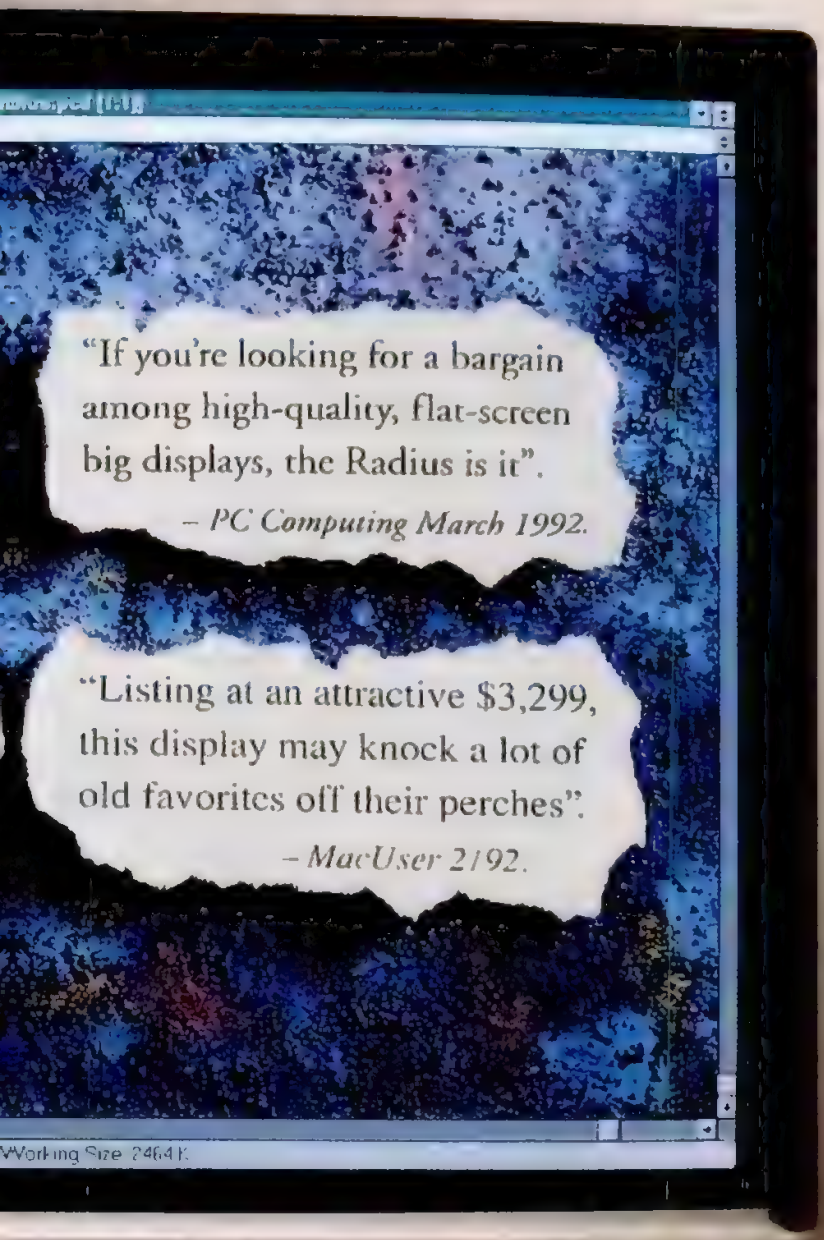

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CIRCLE 234 ON READER SERVICE CARD

radius

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OUR CONTRIBUTORS

Sheryl Canter is associate editor of applications development at *PC Magazine*.
Charles Petzold, Richard Hale Shaw, and **Barry Simon** are contributing editors to *PC Magazine*.
Paul Bonner is the author of the *PC/Computing Guide to Customizing Windows 3.1*, a guide to Windows programming for nonprogrammers, published by Ziff-Davis Press.
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Ben Myers is a Boston-based consultant who writes regularly for *PC Magazine*.
James E. Powell is a Seattle-based writer and author of *Designing User Interfaces* and *FoxPro Developer's Library*.

plementation of the test applications, but we soon realized that it was virtually impossible to compare performance fairly in a group of such vastly different products. To ensure that each product was implementing exactly the same thing, we would have had to bypass its built-in features (for example, ObjectVision's built-in database facilities). And to compensate for product limitations, external DLLs that are not part of the base products would have had to be used extensively. As this category of software matures and the features sets are expanded, we will be able to look more closely at performance.

WHAT WE FOUND

VDEs are supposed to make Windows programming easy. Do they? Interestingly enough, most of our reviewers found the job of using a VDE to create these two sample applications akin to cruel and unusual punishment. Designing the user interface was often a snap; adding a few lines of code was fairly easy; but writing the rest of the code to implement full functionality just got harder and harder.

Is anyone surprised? While VDEs allow you to get started in Windows programming more quickly, programming is still programming. Most VDEs are not for nonprogrammers.

In fact, all of the programs except for ObjectVision required either a knowledge of a programming language or a proprietary scripting language to get the job done. These packages can help programmers easily develop the graphical interface, but they still require a fair amount of technical savvy. It would be rather trivial for a nonprogrammer to design the screen elements of a program, but not trivial at all to make the interface functional.

THE EASE AND POWER TRADEOFF

VDEs have an inherent danger. By simplifying some aspects of programming, they may also sacrifice power and flexibility. What if you need to do something that's not directly provided for by the language constructs of the VDE? For example, what if you need to perform program looping in ObjectVision or create menus in Spinnaker PLUS? Such obstacles can be quite daunting, particularly if you discover the problem late in the development process.

You may attempt a workaround by fighting the VDE and using it in ways that were never intended. You may resort to making direct Windows function calls. Or you may decide you need a dedicated DLL, most likely written in C. Hurdling such an obstacle may well eat up all the time you've saved by using the VDE to begin with.

If you code an application in C using the Windows API, you get a very important guarantee: If you can't do what you want, it's because Windows won't allow that, not because you've chosen the wrong development tools. A VDE can't guarantee this.

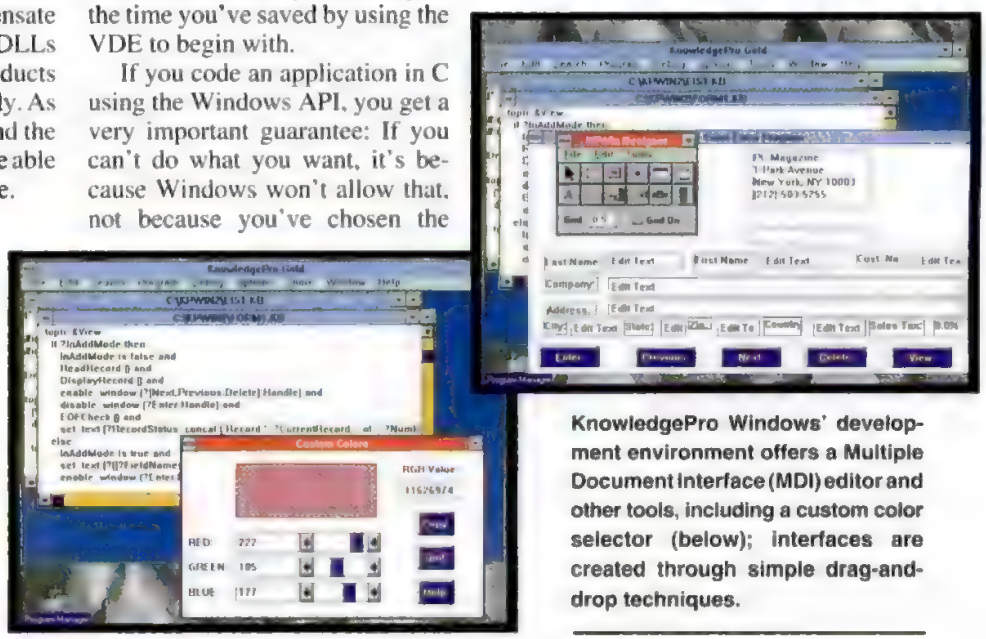
Like many innovative products, the VDE encapsulates the most productive developments of the past while illustrating a clear course for the future. That these products do not yet meet the high criteria we've set should not detract from the brilliant concepts behind their design. The next generation of VDEs should prove quite remarkable.

KNOWLEDGE GARDEN INC.

KnowledgePro Windows

BY RICHARD HALE SHAW Although it's a visual development environment (VDE), KnowledgePro Windows, Version 2.0, is in many ways unlike the other products reviewed in this story. It has roots in expert systems, hypertext, and its DOS-based predecessor. Like Visual Basic, KnowledgePro lets you use an interface design tool to create an interface and then tie together the program's components with the KnowledgePro language. But the $249 package uniquely offers true object-oriented capabilities that let you derive new program components from old ones without having to copy and paste code.

KnowledgePro Windows 1.0 won *PC Magazine*'s Best of 1990 designation, and the $549 KnowledgePro Windows Gold 2.0 (the version with a runtime module) is



KnowledgePro Windows' development environment offers a Multiple Document Interface (MDI) editor and other tools, including a custom color selector (below); interfaces are created through simple drag-and-drop techniques.

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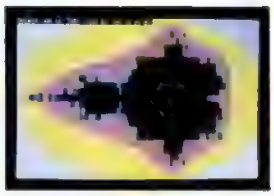

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CIRCLE 138 ON READER SERVICE CARD

the most comprehensive version of the program. In addition to a powerful programming language, KnowledgePro features hypertext facilities, an expert system's inference engine, a rich function library, the ability to integrate bitmaps and icons into applications, an interface designer, and support for Windows' dynamic data exchange (DDE). The package supports all the standard Windows interface controls, and you can also incorporate and access custom controls stored in a dynamic link library (DLL).

The backbone of KnowledgePro is the KnowledgePro language, which is organized into topics. Unlike functions in other languages, topics can contain data, function calls, and other topics. You can get buttons and other screen objects to react to Windows events and messages by linking them to a topic. You can also create new topics via OOP-style multiple inheritance, where the new topic is derived from the features of more than one existing topic. This lets you build a topic that encapsulates the behavior of a particular screen object and derive new topics with slightly different behavior to create new, customized objects in a program's interface.

The KnowledgePro language is not without its eccentricities: It's largely a typeless language (there are no predefined data types except lists). This can be handy while writing code but confusing when you go back to modify it. Besides the naming conventions, the syntax and the use of a period to terminate an expression can be disorienting to those of us used to C, C++, and Pascal. However, KnowledgePro compensates with default parameters for some functions and topics, so you can actually end up writing less code than you'd imagine.

When last reviewed, KnowledgePro lacked a full-featured interactive interface design tool. But KnowledgePro Windows comes with Designer, which you can use to lay out an application's interface. You select the controls—buttons, scroll bars, and combo boxes, among other things—from the Designer toolbar and position them on the surface of the application window. Designer will also let you create hypertext regions—rectangular areas that extend over a graphic or a text element and whose topics can react to user input. You can also use Designer to create modeless, floating dialogs and to specify whether a window has a sizing border or a system icon, for example. Once your

SUITABILITY TO TASK

KnowledgePro Windows				
Menu creation	●	●	●	●
Form creation	●	●	○	○
User interface objects	●	●	●	●
Graphics handling	●	●	●	○
Text handling	●	●	●	●
Programming/debugging	●	●	●	○

program's interface is complete, you use the KnowledgePro environment to modify the code generated by Designer and complete the application.

Unfortunately, Designer is one component of KnowledgePro that's not entirely bug-free. Consequently, it took a good deal longer than expected to create the interfaces used in the EIS and form-based applications that were part of our review process. We encountered a couple of fatal errors, and there were a number of instances where Designer simply did not perform as expected—especially when compared with professional interface design tools like the Whitewater Resource Toolkit or even the Dialog Editor found in the Windows Software Development Kit. Finally, there are instances where Designer just didn't come through: It lets you create multilevel menus, but you'll have to tweak the generated source code to get them to perform correctly; and Designer can't display the tabbing order of controls, so you'll have to remember their order or study the generated source code.

Knowledge Garden's technical support personnel were incredibly efficient and able to supply bug fixes and suggestions with every call. But Designer is a component that may have been rushed to market, and it needs a sound round of beta testing before it can be comfortably used to create production applications under Windows.

KnowledgePro's strengths include a rich function library with full support for string and financial operations and the ability to perform set operations against lists. There are topics for performing DDE with other Windows applications, and you can access any Windows DLL and call functions contained therein. In fact, though KnowledgePro does not offer any graphics functions per se, we were able to use the GDI functions in the Windows API to draw the bar chart and pie chart in the EIS application, calling them directly from KnowledgePro. Though KnowledgePro's file-handling functions are adequate, you can acquire the Database ToolKit for KnowledgePro (an additional $249), which provides a DLL for accessing *dBASE* and *Paradox* files from any KnowledgePro application. We used this to develop our test EIS application, and it made file handling easy.

An unusual KnowledgePro feature is that all the tools in the package are written in the KnowledgePro language and provided in full source-code form. The advantage is that you can use the code as a guide to the KnowledgePro language, and you can modify the tools if you wish. (Indeed, Knowledge Garden supplies updates to the tools in source-code form, which you can download from CompuServe and recompile.)

However, the big disadvantage is that this tends to make the tools just sluggish enough to be annoying, even on a high-performance system.

The KnowledgePro royalty-free runtime module, KPWINRUN.EXE, is provided with KnowledgePro Gold. If you don't need the module, you can purchase KnowledgePro Windows 2.0 for $249.

KnowledgePro is not without its rough edges, and it lacks the elegance of a product like ToolBook or Visual Basic. Parts of the package, programs, and documentation suffer from flaws that are inconsistent with its other strengths and qualities.

FACT FILE

KnowledgePro Windows, Version 2.0
Knowledge Garden Inc., Stony Brook Technology Center, 12-8 Technology Dr., Setauket, NY 11733; 516-246-5400.
List Price: $249; version with runtime module (KnowledgePro Windows Gold), $549.
Requires: 1MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later
In Short: KnowledgePro Windows is a powerful visual development environment that both professionals and casual users can enjoy. Although enhanced by its object-oriented approach, it suffers from inconsistencies and loose ends that prevent it from being outstanding.

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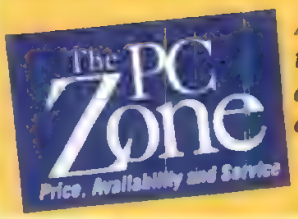

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Microsoft Visual Basic #09465 ..... $128

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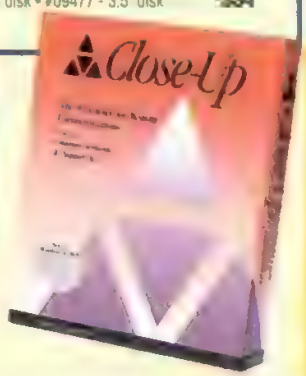

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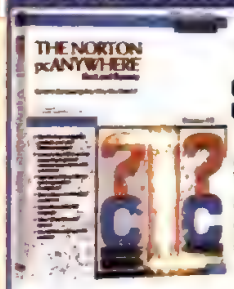


pcANYWHERE 4.5 Host/Remote $118

New V.4.5 Norton pcANYWHERE allows you to take control of another PC running under DOS or Windows via serial or modem connection, and perform background file transfer and general communications. Symantec • #07652 - 5.25" disk • #07653 - 3.5" disk

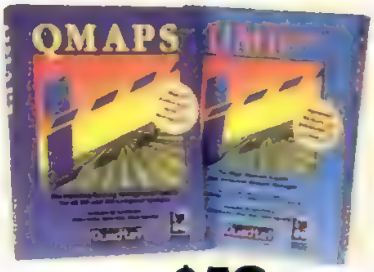
Crosstalk for Windows 1.2 $122

The engineering excellence of Crosstalk is available to the Windows user in a full-featured, asynchronous communications package designed specifically for Windows. It's easy to master, supports DDE, features an easy script language and offers excellent background operation. Info Product of Year 1991. Crosstalk #07385

Crosstalk Communicator #09042 ..... $84

Procomm Plus 2.01 $68

A powerful, easy-to-use communications software package, ProComm Plus 2.01 includes: 33 popular terminal emulations with keyboard remapping, 15 error correcting file transfer protocols, advanced host mode for unattended remote access with electronic mail, file transfers and fully automated dialing directory. Datastorm #09149



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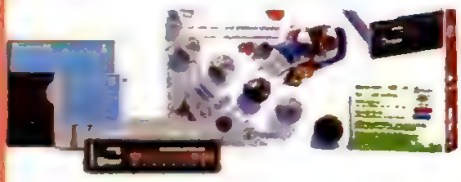


$158 Hayes Optima 24/SC EZ

This low-price 2400bps stand-alone modem features dial-up operation, up to 9600bps throughput and V.42bis data compression. Plus, you get Hayes quality and dependability Hayes #07829

Graphics Ultra 1Mb $434

The Graphics Ultra gives you both graphics coprocessor and super VGA—bundled into one card. It is capable of running Windows 24-times faster than most Super VGA cards, 5-times faster than most TI cards and 10-times faster than IBM 8514/AI. The Graphics Ultra features true 1280x1024 Windows support, powerful Vibrant Graphics CAD drivers and ergonomic 76Hz refresh at 1024x768. ATI #07739

Graphics Vantage 1Mb VGA #07187 ... $324
ATI VGA Wonder+ #09900 ..... $198

Multisync 4FG Monitor 15" $794

Completely redesigned from the inside out, the new MultiSync FG monitors give your PC brighter, sharper, more accurate images. The 4FG, 5FG and 6FG monitors feature the AccuColor Control System which provides unprecedented color accuracy, nothing short of dazzling. Packed with state-of-the-art extras like FullScan capabilities for 36% more screen display. NEC Technologies #7143

3FGX Monitor 15" #07144 ..... $678
5FG Monitor 17" #07399 ..... $1488
6FG Monitor 21" #07182 ..... $3048

#20604

Our recommendation: Go into KnowledgePro with your eyes open. KnowledgePro has the potential to be one of the most powerful VDEs, but only if Knowledge Garden does some housecleaning. The flaws we encountered may put off professional programmers and discourage beginners—which is a shame in a product that is really quite mature.

MICROSOFT CORP.

Microsoft Visual Basic

BY JIM KORENTHAL Microsoft Visual Basic has been touted as a revolutionary product, one that could fundamentally change the way we think about programming. More than any other program in this review, the $199 Visual Basic fits our definition of a true VDE. It fully integrates the design of the graphical user interface with underlying fragments of BASIC language code that process user actions.

Designing a user interface with Visual Basic is not only easy, it's fun. You design the elements of the interface directly on-screen by using a robust set of interactive screen design tools. These interface objects are presented in an attractive and extensible toolbox of icons, which you access by simply pointing and clicking.

The power behind Visual Basic's toolbox is perhaps one of its greatest strengths. The toolbox consists of a palette of icons (called *controls*) that give you point-and-click access to numerous interface objects: picture, text, check, radio, list, combo, and file dialog boxes, scroll bars, labels, buttons, frames for grouping controls, and a timer—an invisible control that lets you trigger actions based on elapsed time.

Each object comes with a set of properties that you can inspect and customize via the Property Bar. Changes are reflected immediately; when you change an object's color, it will immediately appear on-screen in the new color.

Events are handled with similar ease. The events that Visual Basic can recognize range from simple actions, such as a mouse click, to complex actions like drag-and-drop. Code can be attached to any object for any event. Pull-down menus

APPLICATIONS DEVELOPMENT
VISUAL ENVIRONMENTS

More than any other program in this review, Microsoft Visual Basic fits our definition of a true visual development environment.

with comprehensive lists of objects and the possible events associated with them make the process easy to manage.

THE PROGRAMMING LANDSCAPE

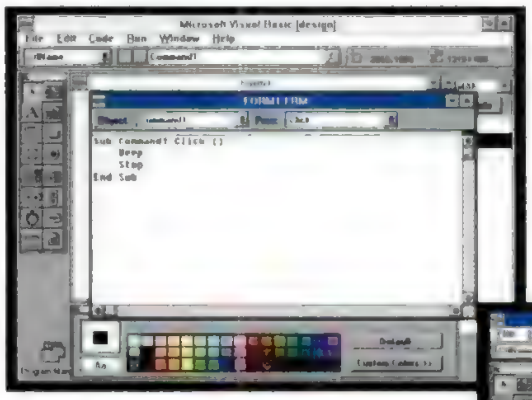
To specify what actions to perform when an event occurs, select the event and double-click on the object. This will open a text window where you can type BASIC statements or import BASIC code from other programs. The BASIC in Visual Basic is not the standard version; some commands are missing, and others are added. But the core language is similar enough that the changes needed will usually be minor.

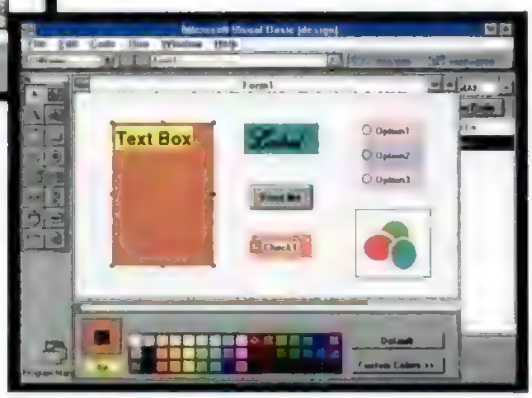
Nonprogrammers will have a difficult time with Visual Basic, since the only way to make these interface elements perform useful functions is to write program code. But Visual Basic's built-in features relieve programmers of many tasks, and as the product matures and more features are added, coding requirements may diminish even further.

Although you are required to write BASIC code, the process is nowhere near as difficult as creating a Windows program with C++ and the SDK. Based primarily on Microsoft's QuickBASIC, Visual Basic has the features of a true programming language, including support for user-defined data types, scoping of variables, and named constants. Because the event handler is part of Visual Basic itself, you can write object-oriented event-driven Windows programs without having to learn an object-oriented programming language, a new style of programming, or the inner workings of Windows events and messages.

Visual Basic provides a full-featured debugger. The Immediate Window lets you inspect and modify program variables or object properties while your program is running. It also lets you test the effect of executing a procedure with different sets of arguments; the Immediate Window can be used to issue any BASIC statement during program execution. You can step through your program by statement or by procedure, and you can choose to begin execution in the middle of your program. Breakpoints are set by clicking on a line of code; when program execution reaches the breakpoint, a code window opens.

Once your program is complete, you can create a standalone .EXE file that will run under Windows without a runtime module. Although compiled Visual Basic programs are typically quite small (unless they contain bitmaps), you must also supply users with the 270K Visual Basic DLL, which can be distributed without royalties. Not all VDEs can generate the standard Windows interface elements such as pull-down menus and file dialog boxes,





Microsoft Visual Basic creates objects in your application with a simple point and click on the toolbox (shown on the left of the lower screen). Double-clicking on any object opens a text window (shown on the upper screen) where you can write event procedures. Above the toolbox is the Property Bar.

SUITABILITY TO TASK: Microsoft Visual Basic				
Menu creation	●	●	●	●
Form creation	●	○	○	○
User interface objects	●	●	●	○
Graphics handling	●	●	●	●
Text handling	●	○	○	○
Programming/debugging	●	●	●	●

but with Visual Basic it's possible (though not mandatory) to make your application look like a standard Windows application.

A LIVELY THIRD PARTY

In case the toolbox that ships with Visual Basic isn't enough for you, Microsoft has made it easy for developers to add new icons to the environment via the custom CDK (Control Development Kit). As a result, there is a large and growing market of third-party add-ons to the Visual Basic environment (see the sidebar "A Guide to Microsoft Visual Basic Add-on Controls"). Microsoft has just released an add-on product called the Professional Toolkit, which can be purchased separately for $299 and is bundled with Visual Basic for $499. The Professional Toolkit adds pen support, grid and graphing capabilities, 3-D radio buttons, multimedia support, and other features.

The Professional Toolkit also comes with the CDK, so you can create your own custom controls in addition to those provided, or you can purchase the CDK separately for $49.95. But if you want to create your own custom controls via the Control Development Kit, you should know that this requires a solid programming background in a language such as C.

Visual Basic's documentation is clearly written and attractively presented. There is also an extraordinary amount of detailed, on-line help. In fact, it's possible for an experienced programmer to create applications without ever opening the manuals, although the Programmer's Guide is useful for bringing concepts together.

If you don't have any add-on products to aid in development, you need to do a significant amount of coding to produce our test applications in Visual Basic. You don't have built-in restrictions to combat, but neither do you have built-in tools such as database front ends and graphing functions to ease your way. However, the Professional Toolkit includes some of these features and can decrease development time significantly.

Visual Basic isn't perfect. A number of the features that are built into other VDEs are not included. There is no hypertext support as there is in ToolBook; you can't include more than one font size and style within a text box or label. There is an undocumented design time limitation of about 300 characters in a text box or label. And there is no built-in database support. But thanks to Visual Basic's open architecture, add-on products can provide much of what the environment lacks.

Even with its shortcomings, Visual Basic comes the closest of any product in this roundup to being the perfect incarnation of a VDE. It offers a well-executed balance between ease of use and programming power. With its low list price, you can hardly go wrong with Visual Basic.

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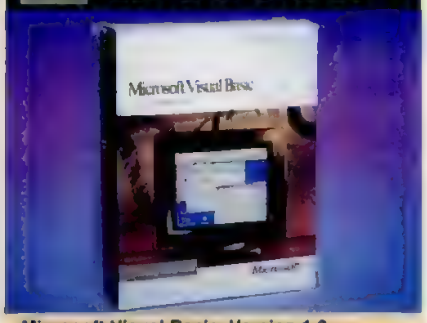

Microsoft Visual Basic, Version 1.0
Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-882-8080.
List Price: $199; bundled with Professional Toolkit, $499.
Requires: 1MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: Microsoft Visual Basic lets programmers quickly create self-contained, production-quality Windows applications. It combines visual interface design with the power of a full-featured programming language. This product is a pleasure to use; it sets the standard for VDEs.

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MATESYS CORP.

ObjectScript Professional

BY BEN MYERS Matesys Corp. bills ObjectScript as a tool for nonprogrammers, but nonprogrammers will have a very hard time with it. Programming in ObjectScript BASIC is required to create applications. In addition, ObjectScript is more complex to use than many of the other VDEs we reviewed. Compounding the difficulty is its lack of context-sensitive on-line help, along with printed documentation that is poorly organized and does not clearly explain how the parts of ObjectScript fit together.

Furthermore, the ObjectScript development environment is not as integrated as many of the other VDEs in this roundup. The environment is broken into two parts: the interface designer, termed *editor* by Matesys, and the ObjectScript BASIC compiler. ObjectScript BASIC programs,

SUITABILITY TO TASK: ObjectScript Professional				
Menu creation	●	●	○	○
Form creation	●	●	●	●
User interface objects	●	●	●	○
Graphics handling	●	●	●	○
Text handling	●	●	○	○
Programming/debugging	●	●	○	○

or *scripts*, are needed to make the interface objects come to life. A complete ObjectScript program consists of two files with like names and different extensions: a screen file containing the visual interface objects and a script file. The screen file generated by ObjectScript is binary and cannot be edited directly.

ObjectScript comes in three flavors: ObjectScript ($150), ObjectScript Professional ($499), and ObjectScript Professional C ($899). All three versions rely on the ObjectScript BASIC dialect as their scripting language.

The difference between ObjectScript and ObjectScript Professional is that the professional version includes a spreadsheet-like table object for inclusion in your applications. To distribute your applications with the necessary ObjectScript runtime module, you'll need the Professional C version, which also includes interfaces for calling ObjectScript functions from C programs.

TIME SAVINGS, DESIGN CONSTRAINTS

Designing forms with ObjectScript is easy to do, and the terms used in the dialog boxes are largely self-explanatory. This is fortunate, since the interface designer has no on-line help facility. Placing an object on a form is a conventional point-and-click process: Select the type of object

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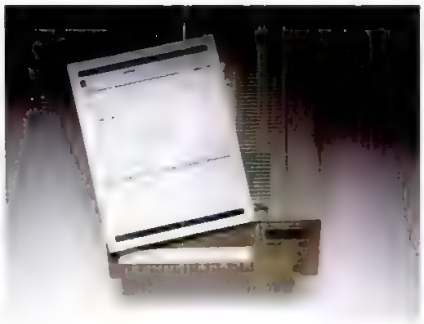

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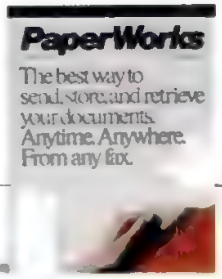

System Requirements: 386SX, 386, 486SX or 486 PC with a mouse. 4MB RAM. Windows 3.0 or 3.1 and DOS 3.1 or later. Intel SatisFAXtion, The Complete Fax, The Complete Communicator, or CEI proFAX fax card. A hard disk with at least 20MB available.

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ObjectScript Professional, Version 1.04
Matesys Corp., 900 Larkspur Landing Circle, #175, Larkspur, CA 94939, 800-777-0545 ext. 133, 415-925-2900 ext. 133
List Price: $499; with runtime module, application distribution rights, C interface, $899.
Requires: 2MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later
In Short: ObjectScript Professional's development environment consists of two separate but related pieces: the visual interface designer and the ObjectScript BASIC compiler. It is up to the programmer to make these two pieces work together. ObjectScript's inadequate documentation, lack of debugging tools, and relatively high price tag make it hard to recommend.

CIRCLE 473 ON READER SERVICE CARD

from the pop-up menu, fix the upper-left corner of the object with a mouse click, and stretch it to size by dragging the mouse. There is no auto-sizing of objects. Once placed on the form, the object can be selected with a mouse click when you want to move or resize it. Double-clicking on an object triggers the first in a series of dialog boxes that establish its relationship with an ObjectScript BASIC function. You can also group objects together and move them around on a form.

ObjectScript provides most of the typical Windows objects: menus, dialog boxes, geometric shapes, and picture boxes, but its ability to customize controls and menu selections is limited. It does not support graying of buttons and menu choices; they can only be hidden—made completely invisible. Programming is necessary to make them visible again at the right time.

The ObjectScript Mini Album is a small utility that captures bitmaps from anywhere on a Windows screen and copies the image into the Clipboard. You can then select a Picture object on the form and paste the bitmap into it. ObjectScript has 40 samples of clip art in resizable Windows Metafile format (.WMF) for use in applications.

Finding the information you need in ObjectScript's documentation can be a lengthy fishing expedition.

Supported text formats include alphabetic, numeric, date, Boolean logic, and template types. The template type is the programmer's escape hatch for special text formatting, as in local currency symbols and telephone numbers.

PROGRAMMING WITH OBJECTSCRIPT

The ObjectScript BASIC dialect is a rich one and provides read and write access to files in ASCII, binary, Xbase, *Paradox*, and Btrieve formats, the latter requiring a Novell-supplied DLL. It also gives you complete access to the Windows SDK and other DLL functions, so an ObjectScript program can do most anything that an application written in C can do.

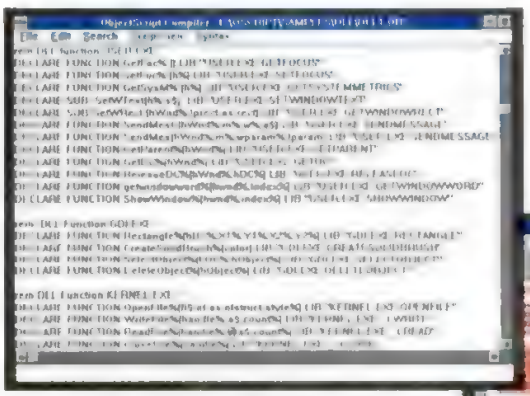
The ObjectScript BASIC compiler has a simple Notepad-like program editor with a pop-up menu to access information about ObjectScript BASIC syntax. The Syntax Help dialog box contains a list of all ObjectScript BASIC commands. Clicking on a command displays its syntax along with an explanation of what it does. The Syntax Help Copy button is a convenient way to get an ObjectScript BASIC statement right; it pastes the correct command syntax from the Help dialog box into the program editor window.

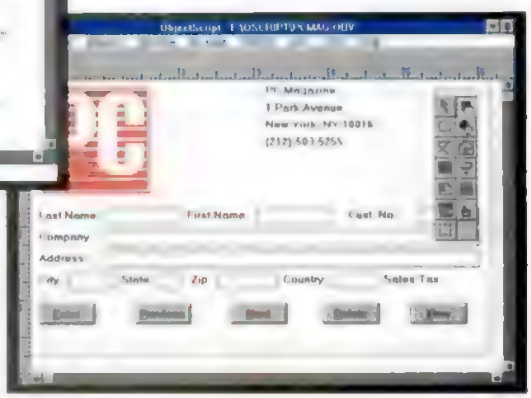
ObjectScript forms (OBV) and scripts (OBS) must work together. The name assigned to an object within a form is typically the same as a function name within a script. The need to describe these relationships in your ObjectScript form is a shortcoming; most other VDEs make this linkage for you. There is no on-line help on how the compiler works in conjunction with the interface designer (or on any topic other than command syntax). In fact, this information is not well documented anywhere; neither the manuals nor the sample programs provide adequate explanations.

The difficulties increase when you try to compile your program. The error messages generated by the ObjectScript BASIC compiler are terse and do not explain the cause of an error or how to correct it. Nor is there is any printed documentation to supplement the error messages. Finally, ObjectScript does not provide a debugger.

PUTTING THE PIECES TOGETHER

The ObjectScript documentation is in two volumes: a user guide and a function reference. Although the documentation is abundant, explanations are often unclear, and finding the information you need can be a lengthy fishing expedition. The manuals do not use either of the two typical means to make it easy to find what you need: thumb-indexed sections or a complete volume-by-volume index. There is one skimpy index for the two-volume set, and another index for function names and function categories. Readability could be improved by using different type styles to set off chapter and section headings and program source-code examples.





ObjectScript has a movable toolbar and ruler to simplify the design of visual forms. The package gives access to any available DLL functions, including those in the Windows SDK shown above.

SUMMARY OF FEATURES

Products listed in alphabetical order

◆—Editors' Choice
■—Yes ❑—No

	KnowledgePro Windows	Microsoft Visual Basic	ObjectScript Professional	ObjectVision	Realizer	Spinnaker PLUS for Windows 3.0	ToolBook	VZ Programmer
List price	$249.00	$199.00	$495.00	$149.95	$395.00	$495.00	$395.00	$595.00
GENERAL FEATURES								
Report generation utility	❑	❑	■	Optional	❑	Optional	■	❑
OS/2 version	❑	❑	❑	■	❑	❑	■ (OS/2 1.0)	■
Event-driven design	■	■	■	■	❑	■	■	■
Execution requirements	Runtime	DLL	Runtime	Runtime	DLL	Runtime	Runtime	Runtime
Royalty-free distribution	Optional	■	Optional	■	■	❑	■	Optional
Animation	❑	Optional	■	❑	■	■	■	■
Programming language used	Propnetary	BASIC	Proprietary	None	BASIC	Proprietary	Proprietary	C++
Pen support	❑	■	❑	■	❑	❑	❑	❑
INTERFACE OBJECTS								
Push buttons	■	■	■	■	■	■	■	■
Radio buttons	■	■	■	■	■	■	■	■
Scroll bars	■	■	■	❑ (except in tables)	■	❑	❑	■
Check boxes	■	■	■	■	■	■	■	■
List boxes	■	■	■	■	■	❑	■	■
Combo boxes	■	■	■	■	■	❑	■	❑
Dialog boxes	❑	■	■	❑	■	❑	■	■
Fields	■	■	■	■	■	■	■	■
Tables	■	Optional	■	■	■	❑	❑	■
Labels	■	■	❑	■	■	■	■	■
Turns bitmaps into icons	■	■	■	■	■	■	■	■
Programmer can create Windows-style menus	■	■	■	❑	■	❑	■	■
Hypertext support	■	❑	❑	❑	❑	■ (limited)	■	❑
GRAPHICS FUNCTIONS								
Can import bitmaps	■	■	■ (via Clipboard)	■	■	■	■	■
Programmer can edit bitmaps	❑	❑	❑	❑	❑	■	■	❑
Charting capabilities:								
Bar charts	❑	Optional	❑	❑	■	Optional	❑	■
Line graphs	❑	Optional	❑	❑	■	Optional	❑	■
Pie charts	❑	Optional	❑	❑	❑	Optional	❑	■
Drawing capabilities:								
Lines	❑	■	■	■	■	■	■	■
Arcs	❑	■	■	❑	❑	❑	■	■
Circles	❑	■	■	❑	■	■	■	■
Rectangles	❑	■	■	■	■	■	■	■
Rounded rectangles	❑	❑	■	■	■	■	■	■
DEVELOPMENT ENVIRONMENT								
Icon-activated functions	■	■	■	■	■	❑	■	■
Bundled libraries or DLLs	■	■	❑	■	■	■	■	■ (ANSI C only)
Open architecture:								
Access to Windows API	■	■	■	■	■	■	■	■
Access to DLLs	■	■	■	■	■	■	■	■
Can add new icon-activated functions	❑	■	❑	■	■	❑	■	■
Can convert DLLs into icon-activated functions	❑	■	❑	❑	■	❑	■	■
Support for DDE	■	■	■	■	■	■	■	❑
Support for OLE	❑	Optional	❑	■	❑	❑	❑	❑
Can import code	❑	■	❑	❑	■	❑	❑	■
Debugging tools:								
Design-time	■	■	■	Optional	■	❑	■	■
Runtime	❑	❑ (no .EXE debugging)	❑	Optional	■	❑	■	■

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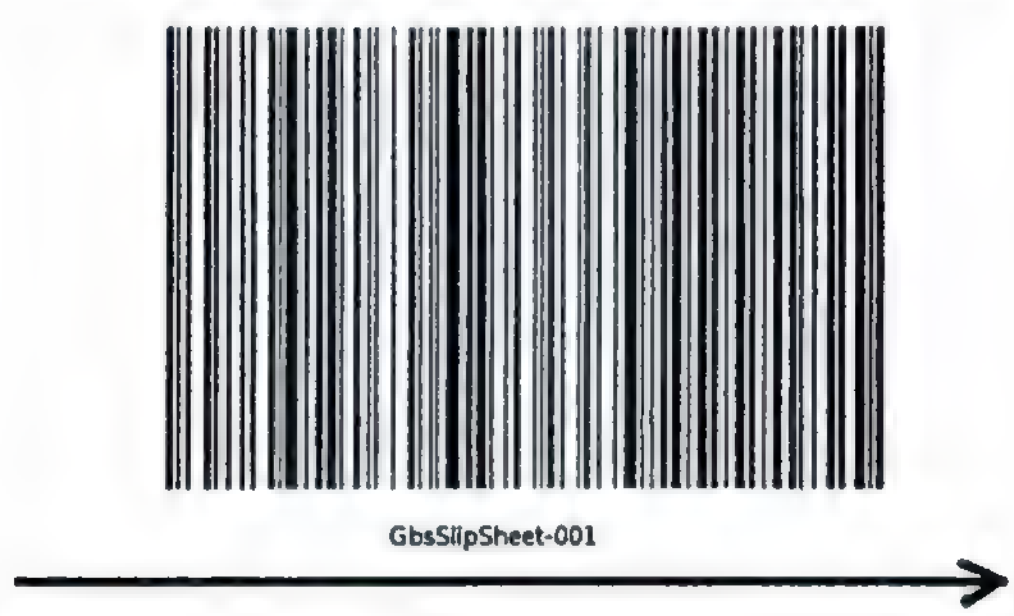

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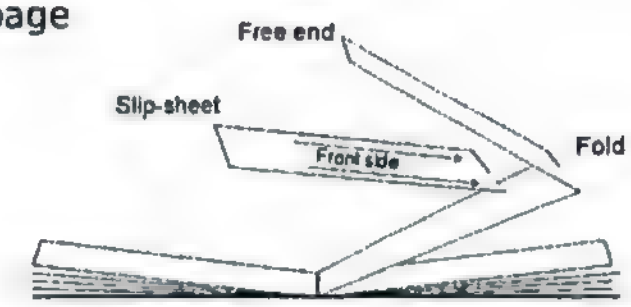
3. Slice the folded edge
4. Close the page and slip-sheet



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1. Follow instructions on the other side

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The People's Choice.

VDEs are supposed to enhance productivity by enabling rapid Windows application prototyping, but ObjectScript needs to have several features added before it can be called a productivity tool. Version 1.04, as it now stands, is time-consuming to learn. Its limitations, along with its high price tag, make it hard to recommend.

BORLAND INTERNATIONAL INC.

ObjectVision

BY SHERYL CANTER Borland's ObjectVision, Version 2.0, has many sophisticated features for its low price of $149.95, but it also has many limitations. Whether it's the right VDE for you depends on your application's requirements.

ObjectVision is unique among the VDEs we reviewed in that it is not language-based. Instead, it uses decision trees similar to program flowcharts to describe application logic, making it truly "visual programming" as well as a VDE. This lets nonprogrammers as well as programmers unfamiliar with the Windows API develop Windows applications quickly and easily. Borland took pains to ensure that ObjectVision was developer-friendly by employing familiar concepts wherever possible—for example, its use of *Quattro Pro*–compatible @ functions.

The penalty for this exceptional ease of use is a lack of flexibility. If you are designing an application that uses ObjectVision's built-in features, nothing could be easier. But if your application is more complex, you'll find that fighting ObjectVision is a pretty tough battle.

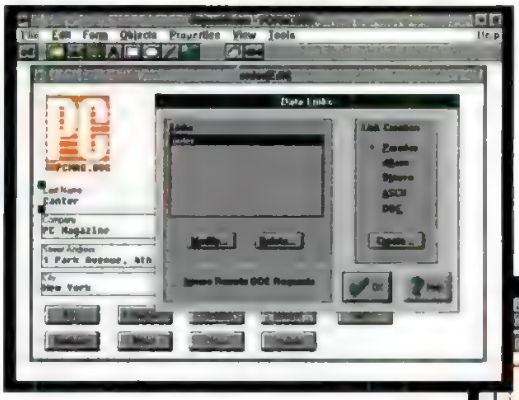
DESIGNING THE USER INTERFACE

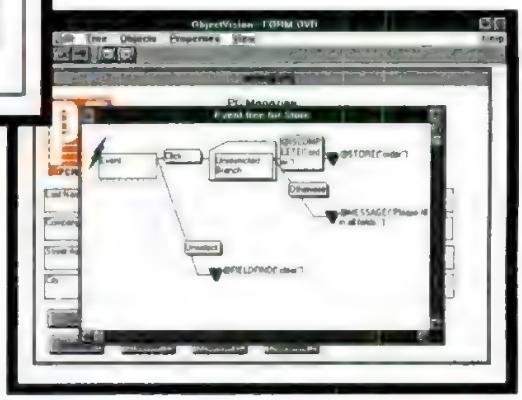
ObjectVision has three main components: interface design, decision-tree logic, and database linkage. The first step in creating an application is to design the user interface. ObjectVision is built on a forms metaphor; multiple forms in an application make up a *stack*. You design the interface by using the Form Tool. A menu bar and an *object bar*—a string of icons that give quick access to interface objects such as fields or buttons—appear across the top of the screen. When you select an interface object (from either the menu or the object bar), your cursor turns into a miniature representation of that object. You then move the cursor to the form, click again, and the object appears where you placed it. You can then move, resize, and customize it.

As the name implies, ObjectVision is object-oriented as well as visual. Each object has a set of properties unique to its class that controls all aspects of its appearance and operation. You can view an object's properties through the main menu, or pop up the Property Inspector by placing the mouse cursor on the object and pressing the right mouse button.

DECISION TREE LOGIC

ObjectVision uses an event-driven model. An object's properties include not only its appearance but also its numeric value (if relevant) and the manner in which it re-





This ObjectVision event tree shows what happens when you click on the Store button. If the form is complete, the record is stored; otherwise a message pops up. When you move off the field, the cursor jumps to the Clear button. The Data Links menu is shown on the upper screen.

SUMMARY OF FEATURES

Products listed in alphabetical order

■—Yes ❑—No

	KnowledgePro Windows	Microsoft Visual Basic	ObjectScript Professional	ObjectVision	Realizer	Spinnaker PLUS for Windows 3.0	ToolBook	VZ Programmer
HELP AND TUTORIALS								
On-line help	■	■	❑	■	■	■	■	■
Sample applications	■	■	■	■	■	■	■	■
DATABASE SUPPORT								
Database creation	Optional	❑	■	■	■	Optional	■	❑
Database access	Optional	❑	■	■	■	Optional	■	❑
Data entry field validation	■	❑	■	■	■	■	❑	■
TECHNICAL SUPPORT								
800 number	❑	■	❑	❑	■	❑	❑	❑
900 number	❑	■	❑	❑	❑	❑	■	❑
Free technical support	90 days	90 days	30 days	Unlimited	Unlimited	45 days	45 days	Unlimited
Bulletin board	❑	❑	❑	❑	❑	■	■	❑
CompuServe	■	■	❑	■	■	❑	■	❑

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CCITT V.42bis / MNP 5	√	√
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SUITABILITY TO TASK	ObjectVision
Menu creation	● ○ ○ ○
Form creation	● ● ● ●
User interface objects	● ● ○ ○
Graphics handling	● ○ ○ ○
Text handling	● ● ● ●
Programming/debugging	N/A

sponds to events such as mouse clicks or "unselection." Value and event decision trees are used to describe the underlying logic.

Decision trees are easily used and understood by nonprogrammers, but they are limited in the logic they can implement; for example, there's no facility for looping. You can get around this by writing a DLL in a standard programming language and accessing it through the @REGISTER function, but if your application is complex enough to require this, you would probably find development easier with a VDE that uses a standard programming language.

ObjectVision provides a list of @ functions and fields to choose from when building your decision trees. Lists of objects and links are not included but should be, since there is nothing to stop you from typing an incorrect name. Testing your application is easy; a mouse click on a special icon flips you into Form Completion Mode, and when you're done testing, a menu selection will bring you back into Design Mode. But if things don't work as expected, you're on your own; ObjectVision lacks any kind of debugging tools.

DATABASE CREATION AND LINKAGE

ObjectVision is one of the few VDEs in this roundup that comes with built-in database linkage, but most other products offer it as an add-on. You can create or link to databases in four formats: *Paradox*, Btrieve, *dBASE*, and comma-delimited ASCII. A newly released SQL add-on can be purchased for $795. Version 2.0 of ObjectVision adds a number of new database features, including one-to-many links and the ability to filter, but unfortunately some basic and necessary capabilities are still missing. Users must resort to more technically demanding database packages for basic database management.

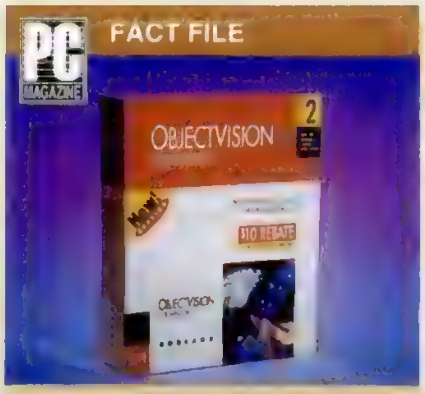
There is no way within ObjectVision to go back and see how you defined a database field; the only way to change indexing after database creation is to delete the link and define it anew. Structuring a database properly is difficult. Even experienced developers modify the design of a database during development; novices are less likely still to achieve design perfection in one pass. Since ObjectVision is meant to be used by nonprogrammers, this is a significant design flaw.

The database link interface is menu-driven, intuitive, and tightly integrated with the rest of the development environment. ObjectVision uses the information in your form to fill in as much of the database information as possible. After you create a new link, you have the option of automatically generating a set of buttons for common chores such as moving to the top of the database, moving to the next record, storing a record, and clearing the form. The buttons are laid out for you, named appropriately, and they include predefined event trees.

EXTRAS AND LIMITATIONS

ObjectVision has many nice touches that make the developer's job easier and provide extensibility. It can utilize *Excel-*

FACT FILE



ObjectVision, Version 2.0
Borland International Inc., 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95067-0001; 408-438-5300.
List Price: $149.95; upgrade from Version 1.0, $49.95 (free if old version was purchased after October 1, 1991).
Requires: 2MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: ObjectVision makes ease of use its highest priority and includes many sophisticated features targeted at forms-based applications. However, the product is innately inflexible compared with others in this review. If you're creating an application that takes direct advantage of ObjectVision's features, your development time will be next to nothing. Otherwise, you would probably save time with a more flexible package.

CIRCLE 470 ON READER SERVICE CARD

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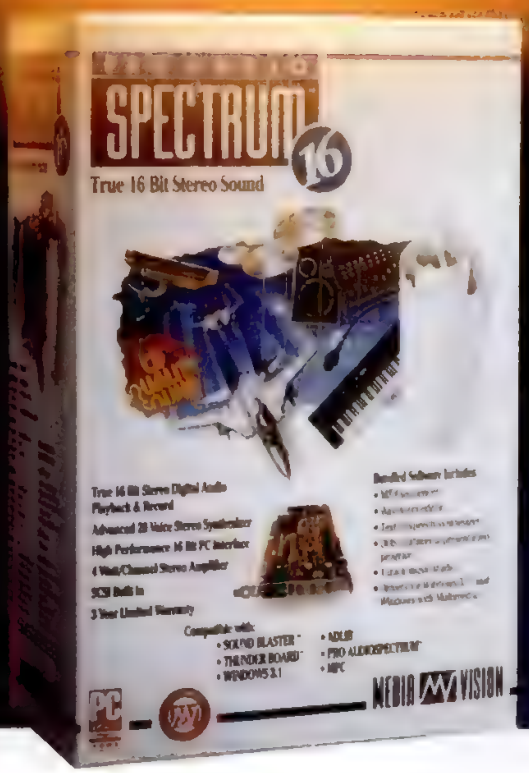

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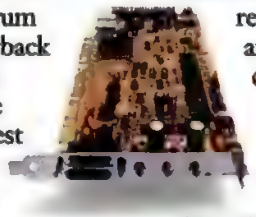

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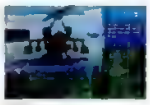
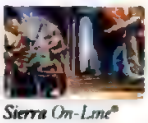

Microprose Gunship 2000

Interplay Productions Star Trek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CIRCLE 093 ON READER SERVICE CARD

compatible DLLs, and the Windows DDE and OLE specifications are both supported. A feature called "intelligent prompting" saves developers from having to spell out the logic of which field to visit next when filling out forms, and data masks prevent end users from entering bad data.

In spite of its sophistication and user-friendliness, you won't want to use ObjectVision to develop applications with any degree of complexity. Although it provides capabilities from many different functional areas, you will quickly find that depth is lacking. You can create databases but you can't manage them; algorithmic complexity is virtually impossible using decision trees. But if your proposed application is simple and straightforward, there's probably no easier package to use.

WITHIN TECHNOLOGIES INC.

Realizer

BY PAUL BONNER Strictly speaking, Within Technologies' $395 Realizer, Version 1.0, is not a VDE at all. Its screen design tool is good but not great, nor is screen design an integral part of the development environment. But if you define a VDE as a productivity tool for developing Windows applications, then Realizer must be included.

With its powerful set of extended user interface elements (including spreadsheet-like grids, charts, animation frames, drawing frames, text-editing controls, and an event scheduler), high-level support for DDE and asynchronous communications, and sophisticated file access and print routines, Realizer simplifies and speeds the process of developing standard data entry, presentation, and analysis applications under Windows. Although procedural programming in BASIC is necessary to build applications with Realizer, the amount of coding needed is drastically reduced by its rich selection of built-in features.

Like Visual Basic, Realizer is built around a structured dialect of BASIC, but Realizer's dialect is greatly extended—a superset of Visual Basic's language.

SUITABILITY TO TASK

Realizer				
Menu creation	●	●	●	○
Form creation	●	●	○	○
User interface objects	●	●	●	○
Graphics handling	●	●	●	●
Text handling	●	●	○	○
Programming/debugging	●	●	●	●

Realizer eliminates the need for DIM and REDIM by offering dynamic arrays and strings, and its high-level file access routines let you save or retrieve all the data for an application with a single command. For instance, the command FileExport ("CLIENTS.DAT," _Realizer, _Named, LName, FName, Company, Phone) would save the complete contents of the arrays LName, FName, Company, and Phone to disk. Realizer also provides direct support for .XLS, .WKS, .BMP, and *Paradox* files, and an impressive set of statistical and time series functions, ranging from StatRegress (which computes a least squares regression line for a set of data points) to StatMovAvg (which determines the moving average for an array).

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CIRCLE 133 ON READER SERVICE CARD

Realizer, Version 1.0
Within Technologies Inc., Laurel Corporate Center, #201 South, 8000 Midlantic Dr., Mt. Laurel, NJ 08054-5080; 609-273-8881.
List Price: $395.
Requires: 1MB RAM, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: Realizer provides an interactive environment for the rapid development of Windows applications. While its visual screen designer is only adequate, Realizer's high-level support for graphics, file and database access, animation, and scheduled operations makes it a powerful and appealing development environment.

CIRCLE 467 ON READER SERVICE CARD

THE SEMI-INTEGRATED ENVIRONMENT

Realizer might best be described as a semi-integrated development environment. The basic environment offers the ability to load the code for one or more programs or program modules into editing windows; then you can edit, debug, and run them. You can either execute your entire program or highlight a few lines and run those, or run some or all of your program through Realizer's interactive debugger.

Realizer Project, which is used to compile completed applications into .EXE format, is a separate application that runs inside of the Realizer development environment but outside of the debugger. The .EXE files it creates are relatively small but must be used in conjunction with Realizer's royalty-free runtime DLL, which occupies over 400K of disk space.

Realizer's visual window design tool, called FormDev, is actually an application written in the Realizer language that runs within the Realizer environment. FormDev looks a good deal like the Visual Basic form editor, but it is much less powerful. FormDev presents a palette of available user interface objects and a blank form on which you can place them. You can modify the characteristics of an item (such as the initial state of a check box or radio button, or the number of panes in a chart), and you can attach action code to the items that you place on the form (such as the steps that should be taken when a button is clicked or a list box item is selected). Unfortunately, there is no syntax checking of this code at the time you enter it. In fact, no syntax checking takes place anywhere within Realizer until you issue the Run command.

Interface object layout in FormDev is not as smooth as it might be. The lack of a layout grid makes controling the exact placement of objects difficult. In spite of this, FormDev does save the programmer time by doing a large portion of the work necessary to create a user interface in Realizer. You have to tweak the code it produces to fine-tune control positions, but that's about all. For instance, you might want to make a row of three buttons all starting at 28 pixels down from the top of the form, rather than at pixels 28, 26, and 29 as FormDev—with its lack of a positioning grid—would have placed them.

Unfortunately, the code-generation process is one-way. You can't load a Realizer code file into FormDev and edit the forms that it contains without overwriting the file. So if you've tweaked the layout positioning or added subroutines, these changes will be lost. The only way around this is to modify the form, save the code under a different name, and then cut and paste between the new code file and the original one—a time-consuming process if you've made significant additions.

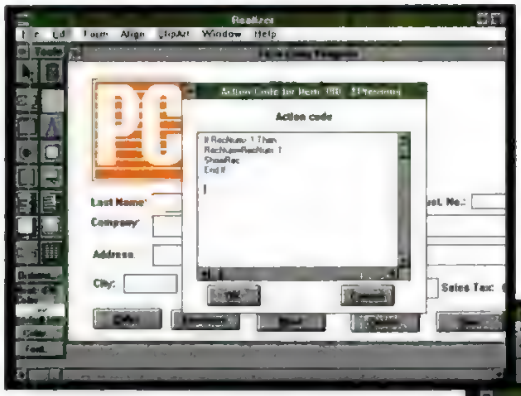
FormDev cannot assist in the menu-building process either. If you want menus, they must be built entirely in code. But even with coding you are limited, since Realizer BASIC does not support hierarchical menus.

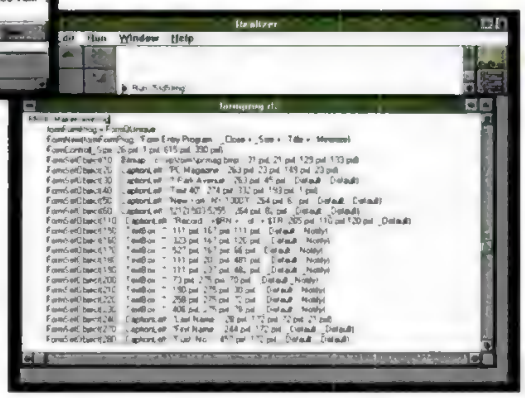
Once you've completed laying out the form, FormDev will automatically generate the code to create it and, at your option, generate the code to process form events. The code to create a button, for instance, might look like this:

```
FormSetObject(410, _Button,
"&Delete", 383 pxl, 322 pxl, 90 pxl,
27 pxl)
```

For the above code, you might put the icon in the form and let the generator work out the parameters, changing them in the debugger. If your application is very simple you could actually write the entire program within FormDev, but in most cases you'll have to enter code from within the Realizer editor. You cannot use FormDev's Action Code window to fine-tune the positioning of interface elements, or build general-purpose subroutines that aren't attached to a user interface element.

For instance, in building our form-based application, the Action Code window was used to indicate that when the Delete button is selected, Realizer should call the DeleteRec routine. But the DeleteRec routine itself was written outside of FormDev using the Realizer editor. If the record deletion code had been entered in the Action Code window for the Delete button rather than put in a subroutine, this would have precluded calling the same code from other routines.





The Action Code window in Realizer's FormDev screen designer allows you to generate code to specify what happens when a user interacts with a specified interface control. The code to create the sample forms application is shown in the lower screen along with Realizer's Debugger window.

In contrast, other VDEs let you create your entire application within the visual environment. With Visual Basic, you can create general-purpose subroutines through its Module BAS files and through general-purpose routines attached to forms, but with Realizer, you have to leave the VDE to create general-purpose subroutines.

A PROCEDURAL MODEL

Realizer uses a procedural model rather than an event-driven one, which in theory means that your code is executed as a hierarchical series of procedures, rather than in direct response to user-interface events. In practice, there is little difference in the results that you obtain. Realizer applications rely on loops that wait for a user-interface event and then respond to it through a giant SELECT CASE statement that evaluates the nature of the event and dictates the program's flow of control in response to it.

Everything that Realizer does, it does well and simply. You can, for instance, import an *Excel* worksheet and create a bar chart from a series of named ranges with just four or five lines of code. But the price you pay for this simplicity is an occasional lack of depth. There are some things that Realizer just doesn't do. One of these is error-checking; the language has no provisions for creating error-handling routines of the standard ON ERROR variety. Instead, the programmer is expected to anticipate and avoid errors in advance. For instance, rather than writing a procedure to handle File Not Found errors, you must make sure that the file exists before you attempt to use it.

In addition, Realizer only provides the ability to process a selected subset of the event messages. For instance, Visual Basic supports 11 separate event procedures for text boxes, including Change, KeyPress, and LostFocus (when an interface element is unselected). Realizer's text controls, on the other hand, generate an event message only when an element is unselected.

You can fake some event messages by using a timer loop, and monitor others by taking advantage of Realizer's external library functions to call the appropriate Windows API functions, but Realizer doesn't provide implicit support for them.

Limitations like these prevent Realizer from serving as an all-purpose development tool, but for business applications, the strength of its tools more than compensates for what it lacks. Features like its built-in event scheduler or spreadsheet and graph controls can eliminate hundreds of hours of programming time and thousands of lines of code. Realizer may not be a fully integrated VDE, but it is certainly an awesome productivity tool for developing Windows applications.

Everything that Realizer does, it does well and simply; however, the price you pay for this simplicity is an occasional lack of depth.

SPINNAKER SOFTWARE CORP.

Spinnaker PLUS for Windows

BY ROBERT DICKINSON HyperCard for the Apple Macintosh was a revolutionary product that offered a different approach to the way people dealt with information. The HyperCard paradigm is based on the concept of a stack of cards. All cards in a given stack share the same backdrop, but each card has its own unique foreground objects. Hypertext and hypermedia are also central components of the HyperCard philosophy. Basically, these techniques let objects and text be linked to specific stacks or cards in order to allow people to explore graphical and textual information in nonlinear ways.

Spinnaker Software has entered the arena of HyperCard-like applications with its $495 Spinnaker PLUS for Windows 3.0. PLUS's use of the HyperCard paradigm makes it similar to ToolBook, also reviewed in this roundup.

THE HYPERCARD PARADIGM

PLUS, like HyperCard, is a tool that visually creates applications by placing various objects on the foreground or background of cards in a stack. The objects provided include several varieties of buttons, graphics, and text fields. Objects placed on a card background will show up on each card in the stack that shares that background. Objects placed on the foreground of a card will appear on only that particular card.

For example, it's easy to create a simple database using PLUS. The first step is to construct a data entry form on a card background. Additional objects such as buttons can be added to the foreground of certain cards to provide specialized functionality or links to other information, other cards, or even other stacks.

All of this can be done without the need for traditional programming. However, any sophisticated application will require the use of the object-oriented programming language that is provided as part of PLUS. There are also facilities provided to allow expansion of the PLUS Programming Language (PPL) and tool set for even more power.

A MACINTOSH MIND-SET

HyperCard stacks can be converted to PLUS stacks with the Macintosh version of PLUS, and the resulting stacks can be used on either the Macintosh or the PC. The interoperability of PLUS stacks is a strong point, but the penalty is that PLUS doesn't take full advantage of the Windows environment.

Spinnaker PLUS for Windows 3.0, Version 2.5
Spinnaker Software Corp., 201 Broadway, Cambridge, MA 02139; 617-494-1200.
List Price: $495.
Requires: 2MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: Spinnaker PLUS, which was ported from the Macintosh, uses a Macintosh-like interface that seasoned Windows users will find awkward. Despite interesting features, it is extremely slow and limited.

CIRCLE 480 ON READER SERVICE CARD

PLUS seems like a Macintosh application even under Windows 3.0. The PLUS developers went out of their way to make it seem Mac-like, right down to the flat monochrome buttons and the wristwatch wait cursor. Many of the dialogs and controls used throughout PLUS are not the highly tuned standards provided by Windows.

In addition to the negative impact this has on Windows' look and feel, PLUS's poor implementation of these controls and dialogs causes many areas of stack usage and development to be very slow. The best example of this is in script editing. A Windows edit control would be fairly fast, but the PLUS version has you waiting between keystrokes when the script gets over 100 lines. The performance that really matters is the speed at which stacks execute, and this is also extremely poor.

CREATING AN APPLICATION WITH PLUS

PLUS stacks are designed graphically using a point-and-shoot interface and a toolbar. The manipulation of objects and graphics is clean and intuitive. An object's properties can be brought up by simply double-clicking on it. The toolbar also provides an easy way to switch between foreground and background editing, along with a clear visual representa-

SUITABILITY TO TASK

Spinnaker PLUS for Windows 3.0				
Menu creation	●	●	○	○
Form creation	●	●	●	●
User interface objects	●	●	○	○
Graphics handling	●	●	●	○
Text handling	●	●	●	○
Programming/debugging	●	●	○	○

THINX: A "What-If" Applications Builder

by James E. Powell

Thinx is a graphical application builder that combines a graphics program and a database with spreadsheet formulas. Think of *Thinx* as a visual spreadsheet/database that helps you play graphical "what if" games. *Thinx* can help you determine hotel revenues based on a floor layout, the cost of landscaping based on the sketch of a garden, or the annual salary expenses based on an organization chart.

Thinx comes without the traditional trappings. There is no language and no debugger; *Thinx* does not create menus, buttons, or list boxes. Instead, it uses objects—graphics images combined with underlying data. You create a picture (a hotel room or a "box" in an organization chart), then double-click on it to define the fields (called *attributes*) for storing the image's data—room rates or an employee's name and salary, for example.

Suppose you are planning an office layout. You create pictures of a conference table, desk, and chairs using the program's built-in graphics tools (lines, rectangles, circles, polygons, patterns, and colors). *Thinx* comes with a toolbox of graphics drawing features that at first make the program look like a graphics program. If you're not an artist, you can import vector and bitmapped images.

Next, double-click on the image to create attributes: list price, shipping cost, vendor's name, color, and so on. You may assign default values for any attribute. You build an application by adding and placing objects on the screen.

Each object can be assigned individual attribute values: You can add a chair object and assign it the color red, then add another chair object and assign it blue. There is no limit to the number of attributes you can assign, and up to five attributes can be displayed surrounding an object. So, for example, you can display the list price below a chair and the vendor name above.

Sophisticated selection criteria let you take action based on attribute values. For example, you can automatically paint chairs blue or red based on their color attribute. You can use different fonts or hide selected objects based on such criteria, too. In a sample application shipped with *Thinx*, a U.S. map contains 50 objects (one per state), with a population attribute for each object. State objects are filled with patterns corresponding to the population ranges they belong to.

Thinx's power comes from special objects called *formulas*. There are 56 mathematical functions to help you tally the total list price of your office layout or count the pieces of furniture. If your objects are drawn to scale, the built-in attributes height and width can be used by a formula object to calculate square footage. When you add or delete objects, or change attributes, formulas can be automatically updated and values redisplayed.

Thinx has limitations. Though it comes with a variety of graphics tools and devotes over 230 pages of the user guide to graphics functions, only the patient (or truly talented) will avoid amateur-looking objects.

Nor is *Thinx* designed to work with large quantities of data: This is *not* the tool to analyze 5,000 inventory records. *Thinx* is agonizingly slow: The population application mentioned above took over 45 seconds on a 20-MHz 386 to display a U.S. map. It took *Thinx* 23 seconds to recalculate a formula when one state's population was changed.

Thinx makes good use of the Windows environment. It supports DDE (dynamic data exchange) with *Microsoft Excel* and can import or export data to *Excel*, *Lotus 1-2-3*, *dBASE*, and Micrografx's *Designer* as well as import CGM files and export .WMF files. Unfortunately, *Thinx* supports only one application on-screen at a time, so you must copy between applications using the Windows Clipboard.

Thinx is unlike anything you have seen before. If you need to analyze data graphically and a spreadsheet's chart capabilities don't fit the bill, chances are that *Thinx* will. ■

Thinx, Version 1.1B
Bell Atlantic, 575 E. Swedesford Rd., 3rd floor, Wayne, PA 19087; 800-688-4469, 215-768-5787.
List Price: $495.
Requires: 2MB RAM (4MB recommended), 5.5MB hard disk space, DOS 3.1 or later, Windows 3.0 or later. Mouse recommended.

CIRCLE 465 ON READER SERVICE CARD

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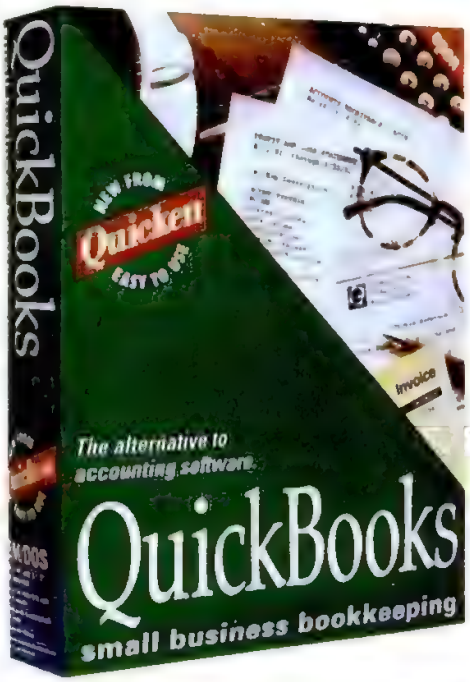

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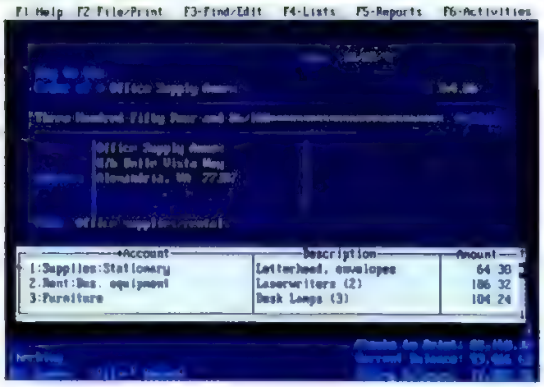
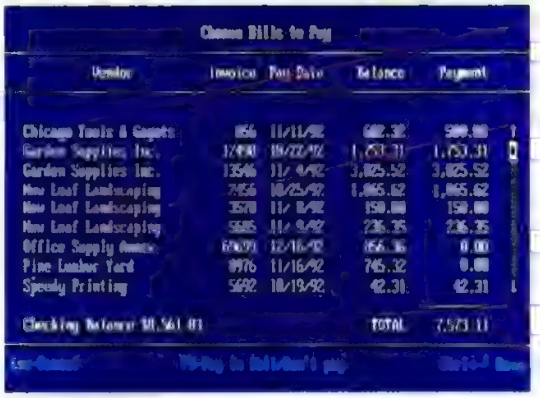


Choose whom to pay and when.



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Payments to the same vendor can be combined.

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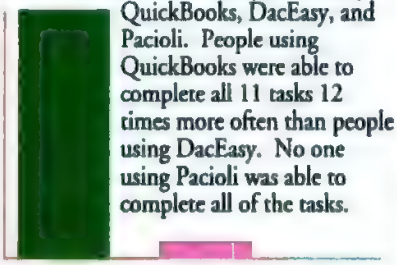

Source: Merrill Research & Associates

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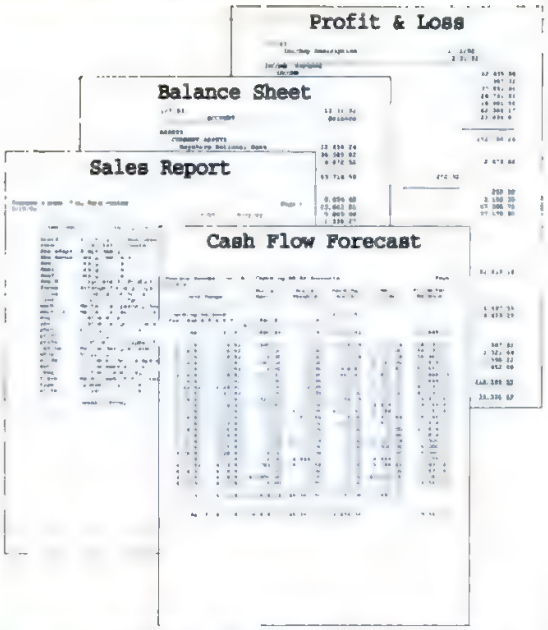

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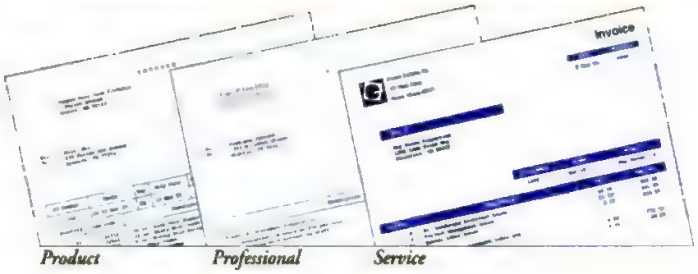

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tion to indicate which mode is active.

A Home stack is provided as a customizable PLUS command center. The Home stack has links to user stacks in addition to user-preference information, and it can be reached with a single button or icon from almost any PLUS stack.

The stock PLUS objects are the product's main strength. The text fields can enforce standard or user-specified data formats without coding. Full-featured word processing fields that support a mixture of fonts, styles, and even colors of text are available.

Limited hypertext support is also provided, but PPL code is required for even the most basic hypertext functionality; text cannot be treated as an object. There is no built-in way to change the appearance of hypertext text; it must be done through program code.

PLUS seems to have provided the Windows-style 3-D push buttons to use in stacks as an afterthought. They can't be selected from the toolbar; instead, PPL code must be used to set the style of each button explicitly in order to get the Windows 3-D effect.

The graphics import function is the weakest part of the visual design process. PLUS supports only bitmap (.BMP) and .PCX file formats directly. In practice, the .PCX import worked fine, but some .BMP files actually had to be converted to .PCX using Windows Paintbrush because PLUS would not import them in .BMP format. There is no support for the Windows Metafile format (.WMF), EPS, TIFF, CGM, .DRW, or any other format.

THE PLUS PROGRAMMING LANGUAGE

The English-like PLUS Programming Language (PLL) is very similar to the HyperTalk language used by HyperCard on the Macintosh. The PPL documentation is excellent, even though it is a little bit light on functional source-code examples. There is an outstanding cross-reference and property list in the appendix. The sample stacks include some useful code as well as complete objects that can be cut and pasted into your own stacks. The Power Tools stack is especially helpful. It contains a large number of PPL functions implemented at the stack level, which can be used to enhance the power of PPL for any stack.

The only real problem with PPL is that there is virtually no debugging support. The code usually works, thanks to the quality and simplicity of the language, but when it fails, finding the problem can get very ugly. You are dropped into the script at the error line, and from there you are on your own. In short, the PPL learning curve is short, but the implementation curve can be long and steep.

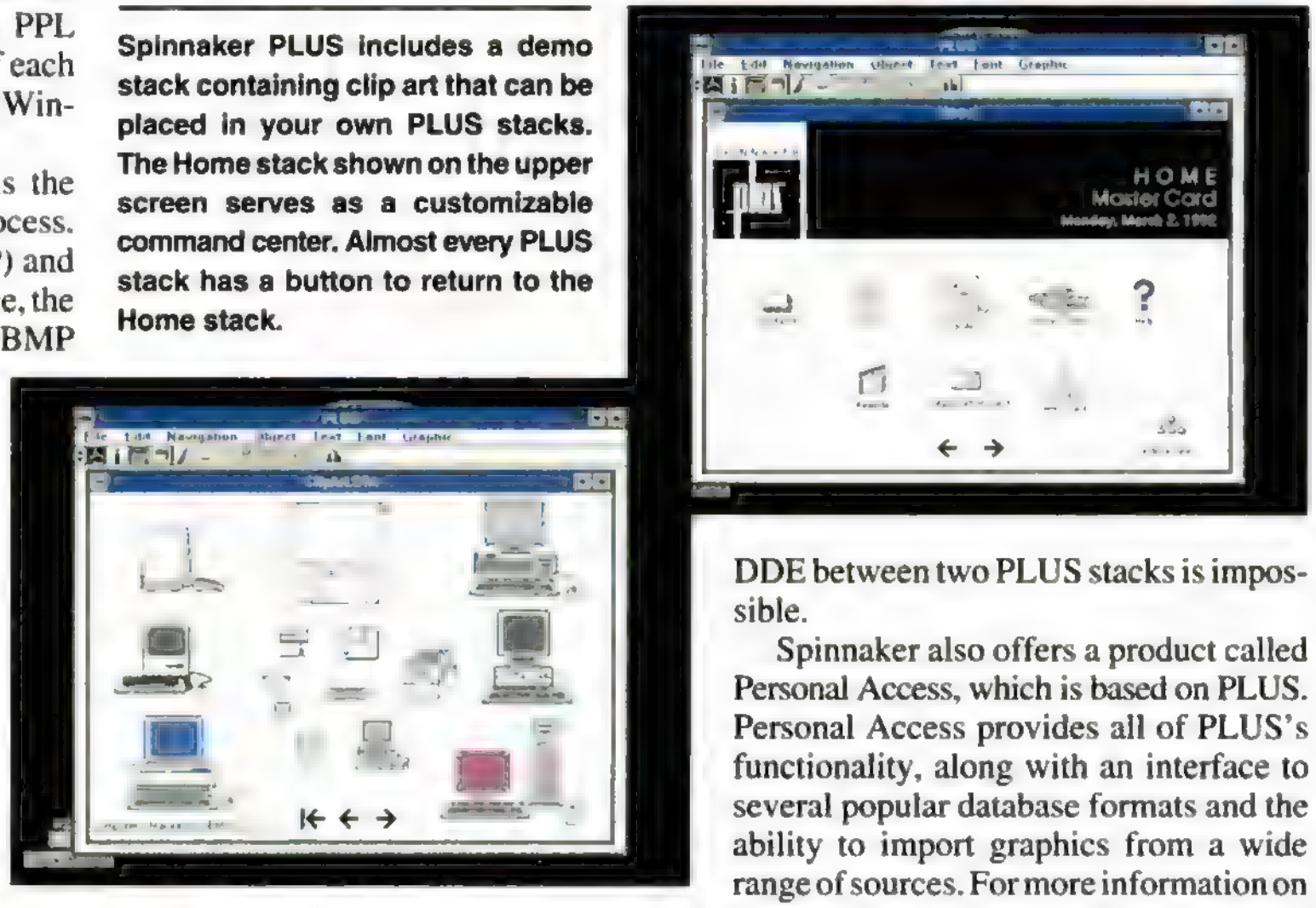
PLUS also implements Macintosh HyperCard-style XCMDs and XFCNs, which allow advanced users to extend the PLUS Programming Language by developing special Windows DLLs that provide needed functionality. Or you can utilize the open Software Slot architecture, which creates Xcommands, Xfunctions, and fully integratable new object classes. These techniques allow PLUS to be enhanced in almost any way with high-performance code.

The downside of XCMDs and XFCNs is that there is no written documentation except for a brief note that says to check the on-line demo stack. The on-line reference is good, but it is not very complete. That the sources suggested for further reference are Macintosh-specific should scare most Windows developers away from this area.

WINDOWS CONSTRAINTS

PLUS can be used to create sophisticated applications under Windows, but it is important to understand that they will not look like traditional Windows applications. A runtime module is needed to run PLUS applications. (Contact Spinnaker for more information on licensing arrangements.) Standard PLUS menus can be hidden, but they cannot be replaced with custom menus. This is because PLUS supports only pop-up menus and not traditional Windows pull-down menus. In addition, there is no facility to change the caption of the main PLUS window or to change the icon that PLUS uses when minimized.

Perhaps the most severe of PLUS's limitations is that you are allowed only a single instance of PLUS, and only a single stack in that instance. This is especially unfortunate since one of the key strengths of Windows is that it allows a number of applications to run simultaneously. PLUS stacks cannot run simultaneously, which means that using DDE between two PLUS stacks is impossible.



Spinnaker PLUS includes a demo stack containing clip art that can be placed in your own PLUS stacks. The Home stack shown on the upper screen serves as a customizable command center. Almost every PLUS stack has a button to return to the Home stack.

Spinnaker also offers a product called Personal Access, which is based on PLUS. Personal Access provides all of PLUS's functionality, along with an interface to several popular database formats and the ability to import graphics from a wide range of sources. For more information on Personal Access, see the First Looks review in the March 17, 1992, issue. PLUS comes bundled with Personal Access for $695 list.

PLUS will make die-hard Macintosh users who work under Windows happy, but Windows users will resent the user interface. In addition, the product is extremely slow and lacking in several major feature areas. PLUS is a first-generation Windows product that simply doesn't measure up against stiff Windows competitors like Asymetrix Corp.'s ToolBook.

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ASYMETRIX CORP.

ToolBook

BY ROBERT DICKINSON Asymetrix Corp. released the first version of ToolBook, a PC equivalent of the Macintosh's HyperCard, in May of 1990 with the rollout of Windows 3.0. Despite its potential, the first version of ToolBook had a serious flaw: It was slow. ToolBook 1.0 was like a Mercedes-Benz with every conceivable option and a top speed of 10 miles per hour. It was interesting and appealing to look at, but you could hardly imagine that someone would actually use it. Well, the $395 ToolBook 1.5 is here, and the good news is that it's much faster. And Asymetrix has included an on-line tutorial called Speedbook that gives detailed explanations of how to make execution even faster.

ToolBook lets users create Windows applications, or *books*, quickly and with minimal programming. Books are ToolBook's central metaphor; they are comparable with HyperCard *stacks* on the Macintosh. HyperCard uses the concept of a stack of one or more index cards; ToolBook uses the concept of a book composed of one or more pages.

As is typical of the HyperCard model, objects in the background are shared by all the pages in a book, while objects in the foreground are unique to a specific page. Objects or groups of objects are placed on the foreground or background of a page to form an application. Each object has several properties, including a script that lets you customize the behavior of the object using the ToolBook OpenScript language.

Several sample books are included in a collection called the Bookshelf. They provide an impressive demonstration of what can be done with the product. The Bookshelf books range from a simple database to an impressive ribbon-style calculator complete with advanced financial functions. There is even a graphical tile game called *Taquin*. Developers can borrow objects from these books for use in their own books, or they can dissect the interesting parts to learn advanced techniques. The popular DayBook application is part of the Bookshelf.

ToolBook's VDE lets you rapidly create the application interface. Standard Windows controls and several geometric shapes can be selected from the floating tool palette and placed into a book. Graphics objects can be imported in a wide variety of formats to create stunning pages.

Objects can be linked to different pages in their own book or to specific pages in another book without any programming. The built-in hypertext system also lets you treat specific words or phrases as objects, enabling links or underlying scripts to be connected to the text. The sophisticated visual linking features of ToolBook allow entire hypermedia applications to be created without any programming.

USING THE OPENSCRIPT LANGUAGE

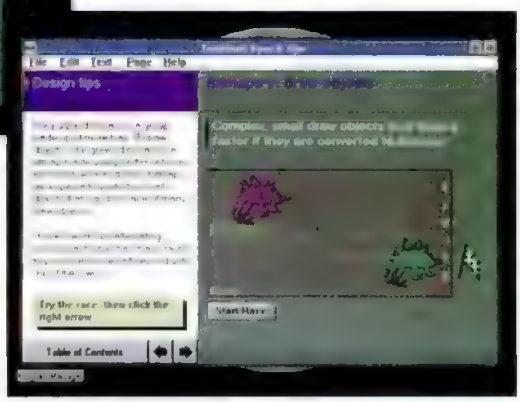
Advanced ToolBook users can take advantage of the OpenScript language to create full-blown Windows applications. OpenScript is a powerful English-like (structured) language that is easy to learn and remember; Asymetrix calls it "structured English." Novice programmers won't be intimidated by OpenScript, and experienced programmers won't be disappointed by its power.

Programming with OpenScript is very straightforward. Simply choose an object, view its properties, and select the script button to bring up the script window. The script window allows entry and editing of scripts, and it provides extensive help for the OpenScript language and the properties of the object to which the script applies.

An OpenScript debugger is also accessible from the script window. The debugger supports multiple breakpoints that are visually marked in the script for quick confirmation. When a breakpoint is reached during the execution of a script, control shifts to the debugger, where developers have access to a set of debugging tools. The OpenScript programming environment is well integrated and easy to learn and use.

ACCESS TO ADVANCED WINDOWS FEATURES

OpenScript provides some advanced features for experienced Windows developers, including a rich command set for implementing Windows' DDE or linking into a Windows DLL. A new facility called Windows-to-OpenScript translation allows ToolBook to translate standard Windows messages into calls to OpenScript han-



The ToolBook SpeedBook, shown on the lower screen, gives developers extensive and specific advice on how to make books faster. The dialog editor shown above creates and implements standard Windows dialog boxes as ToolBook objects.

PC MAGAZINE FACT FILE
EDITORS' CHOICE

ToolBook, Version 1.5
Asymetrix Corp., 110 110th Ave. NE, #717, Bellevue, WA 98004; 206-637-1500.
List Price: $395.
Requires: 1.5MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: ToolBook is a powerful visual development environment that is user-friendly enough for even nonprogrammers to use effectively. Its built-in hypertext support is a snap to use. Version 1.5 is significantly faster than Version 1.0, which resolves the chief complaint about the previous version.

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dlers. There is also an interface to let other Windows applications execute OpenScript statements in a particular book by channeling the commands through a DLL. ToolBook can provide powerful and sophisticated integration in the Windows environment: It can be used to link multiple Windows applications with ToolBook applications or even with each other.

ToolBook provides tools to create standard Windows dialog boxes for use in books. Using ObjectScript, you can modify the ToolBook menus or replace them entirely with specialized application menus, or you can change the icon that's

SUITABILITY TO TASK	ToolBook
Menu creation	●●●○
Form creation	●●●○
User interface objects	●●●●
Graphics handling	●●●●
Text handling	●●●●
Programming/debugging	●●●●

used when the application is minimized. In short, you can create Windows applications for distribution with just the look you want but with ToolBook doing all of the work. Asymetrix provides a royalty-free runtime version of ToolBook as a standard part of the retail product.

As with Visual Basic, there are a broad selection of third-party add-on products available for ToolBook. In addition, a multimedia version of ToolBook lets you add sound and video to your applications. (See the review of Multimedia ToolBook in "Authoring Software: Author! Author!", March 31, 1992, for more details of its special capabilities.)

ToolBook strikes an excellent balance between power and ease in Windows application development. With the improved speed in Version 1.5, ToolBook is now the powerful Windows application development and integration tool for both novice and experienced developers that it was always meant to be.

VZCORP

VZ Programmer

BY RICHARD HALE SHAW VZ Programmer, Version 2.0, is the only VDE reviewed here that is *not* for casual users. With its built-in C++ compiler and object-oriented development environment, the $595 package from VZCorp is strictly for professional software developers. But VZ Programmer also offers a visual, drag-and-drop interface designer, as well as portability, flexibility, and power.

Unless you're familiar with the C programming language and Windows' event-driven, message-based architecture, you shouldn't bother with VZ Programmer. But that's as much as you'll need to know. With VZ Programmer there's no need to write window procedures or handle Windows messages, register window classes, or create windows. You won't need to spend time learning C++ or object-oriented programming, and you don't have to own a C compiler or the Windows Software Development Kit. VZ Programmer is a complete, self-contained Windows development environment.

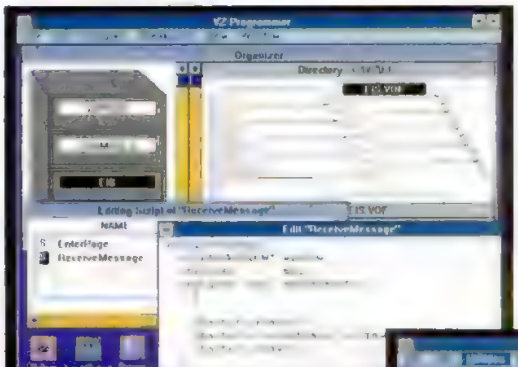
Like ToolBook, VZ Programmer uses a simplified message-based interface and provides system-defined object classes that encapsulate standard Windows controls. It uses an *object-page* metaphor: you select *objects* such as graphics, text, and Windows controls from a toolbar and place them on an application *page*. Each object has specific attributes that describe its appearance. You can modify an object's default behavior by modifying its attributes—particularly its script. Each script can contain message handlers, which you write in C++ rather than a scripting language like ToolBook's OpenScript.

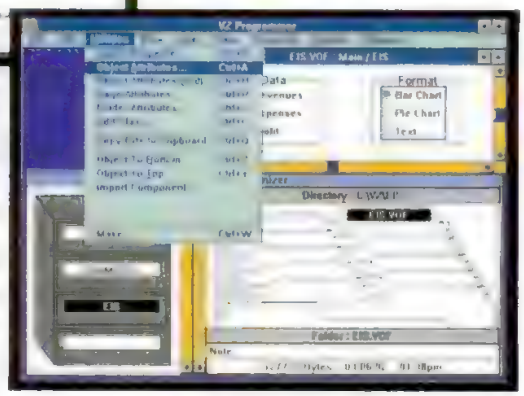
Thus, creating a bitmap button is a simple matter of selecting a bitmap object from the VZ Programmer toolbar and modifying its Button1Up handler (a C++ member function) to react to the message sent when a user clicks on the left mouse button. If an object receives such a message, the object can process it, pass it up the VZ Programmer object hierarchy, or both. You can also create links to facilitate communications between objects. For example, links make it easy to place a list box selection into an edit box.

With VZ Programmer's GUI Construction Kit, you select from predefined classes for the objects in an interface. There's full support for graphical objects such as lines, circles, pie charts, and polygons, as well as all the standard Windows controls except for combo boxes—a surprising oversight. You use the built-in editor, debugger, browser, linker, and MAKE facility to compile your applications into "pseudo-code." Then your applications can be run by the VZ Programmer environment or the runtime facility.

VZ Programmer stores applications and objects in a persistent object database, or *folder*, which is the base of the object hierarchy. Each folder contains one or more *groups*, which in turn hold one or more *pages*, and each page contains *objects*. Persistency lets you save and restore objects to disk with all their attributes and relationships. Along with the ability to create your own classes, this lets you create reusable objects called *software components*, which can be added to any application, or which can be self-contained applications in their own right.

While the product skimps on C-language library support, with only a subset of the standard ANSI C library, you can still lift much of the code from your existing C or





VZ Programmer's object hierarchy divides applications into folders, groups, and pages. The folders, shown on the lower screen, are persistent object databases used to store the applications. Each object on a page has one or more scripts that control the behavior of that object. The editor on the upper screen shows a script for the current page.

VZ Programmer, Version 2.0
VZCorp, 175 S. Main, #1550, Salt Lake City, UT 84111; 801-595-1352
List Price: $595 (unlimited distribution per organization or per application), runtime version, $595 (unlimited-use license within corporation and one application outside corporation) OS/2 version, $995 (same license scheme, $995).
Requires: 4MB RAM, hard disk, DOS 3.1 or later, Microsoft Windows 3.0 or later.
In Short: A powerful, flexible visual development environment for Windows application developers—but not casual users. Its use of C++, an object-based interface designer, and library support make this a viable tool for developers, although it's limited by lack of DDE support and single inheritance.

CIRCLE 472 ON READER SERVICE CARD

SUITABILITY TO TASK

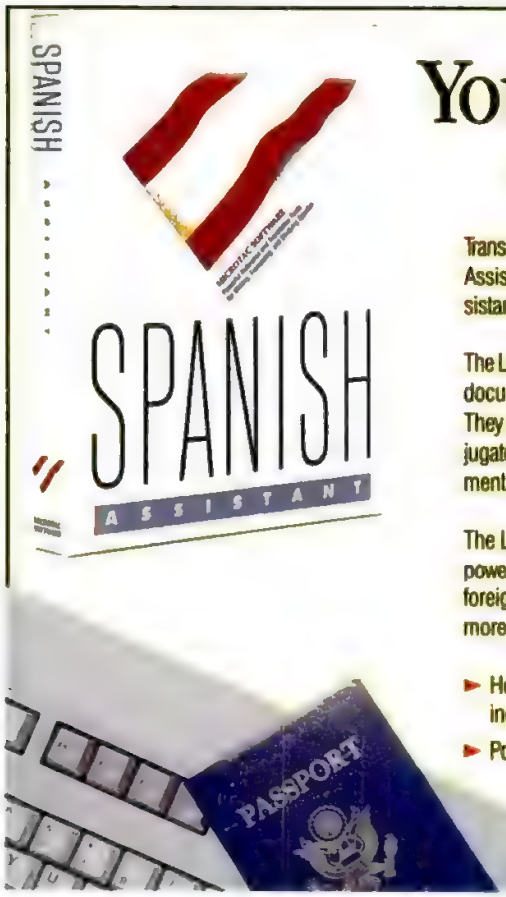
VZ Programmer				
Menu creation	●	●	●	○
Form creation	●	○	○	○
User interface objects	◐	◐	◐	○
Graphics handling	●	●	●	●
Text handling	◐	◐	◐	○
Programming/debugging	◐	●	●	●

C++ applications. There are over 20 predefined object classes for Windows, and over 60 system, menu, and graphics functions; you can derive your own user-defined classes from them, or call any function in a Windows DLL. A version for the OS/2 Presentation Manager is available.

VZ Programmer's built-in C++ compiler will compile ANSI-standard C and AT&T C++ 1.2. Unfortunately, this version of C++ supports only single inheritance, so you can only derive a new object class from one parent class; and it is limited in other ways. For example, labels and Goto's aren't allowed, the *in-line* keyword is ignored, and there's no support for pure virtual functions, abstract classes, or friend functions. This may turn off more sophisticated C++ developers.

VZ Programmer lacks an interactive menu-building facility, and there are no built-in DDE objects or support. Also, you cannot dynamically resize a bitmap with the interface designer; you'll have to write code to do so. As in ToolBook, you cannot access all the scripts or attributes of an application's objects. While the runtime module should be available when you read this, it had not been released as we went to press, and the beta runtime module had some unfortunate limitations. Finally, VZ Programmer's marketing literature and documentation misleadingly describe explicit support for *dBASE* files. This is true only if *you* supply a Windows-based *dBASE* engine in a DLL.

Despite these problems, VZ Programmer is excellent for group or distributed component-based programming, and with some polish around the edges, it could easily be the most powerful VDE of all. While it is not recommended for casual users, professional developers who have been waiting for a "Visual C++" from Microsoft or Borland should take a long look at VZ Programmer. In many respects, "Visual C++" is already here. ■



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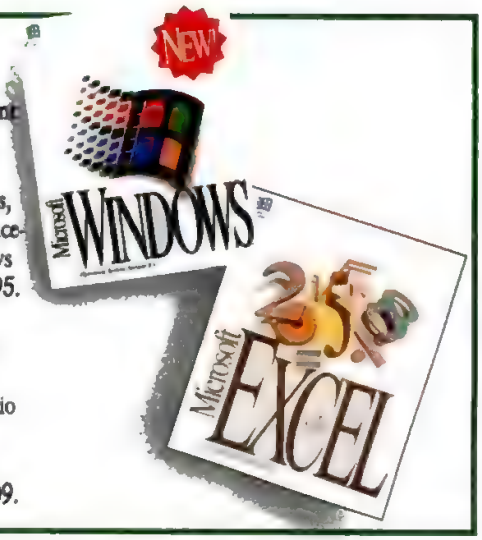

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Inset Systems ... NCP
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3978 ◉ One-Write Plus Accounting 3.0 79
4880 ☐ One-Write Plus Accounting Works 3.0 . 119
5825 ◉ Money Matters 3.0 29
2798 ☐ Managing Your Money 8.0 49
Microcom ... NCP
4408 ◉ MicroCourier 1.0 59
6234 ◉ CarbonCopy Plus 6.0 119
4410 ◉ CarbonCopy Plus for Windows 119
Micrografx ... NCP
3627 ☐ Windows Draw! 3.0 99
Micro Logic Software ... NCP
8579 ◉ MoreFonts 3.0 75
Microsoft ... NCP
3338 ☐ Money 1.0 for Windows [illegible]
7010 ☐ Windows 3.1 95
7388 ◉ Project 3.0 for Windows [illegible]
2904 ☐ Works 2.0 95
2735 ◉ Works 1.0 for Windows 129
3337 ◉ Publisher 1.0 for Windows [illegible]
7387 ◉ PowerPoint 2.0 for Windows [illegible]
6195 ◉ Word 2.0 for Windows 309

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Inset Systems ... NCP
7298 ◉ HiJaak 2.1 . . . . . 139.
3820 ◉ HiJaak 1.0 for Windows 139
7300 ◉ Inset Plus HiJaak . . . . . 165.
Intuit ... NCP
2426 ◉ Quicken 5.0 . . . . . 45.
5596 ◉ Quicken 1.0 for Windows 45
2474 ◉ Quicken with QuickPay . . . . . 75.
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6882 ◉ PrintCache 2.5 . . . . . 99.
Lotus ... NCP
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5653 ☐ 1-2-3 2.3 . . . . . 335.
1852 ☐ 1-2-3 2.3 Upgrade . . . . . 95.
2755 ☐ 1-2-3 1.0 for Windows 399
2747 ☐ 1-2-3 for Windows & Ami Pro 2.0 Upgrd 199
5799 ◉ Ami Pro 2.0 299
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5981 ☐ SmartSuite 469
2750 ◉ cc:mail DOS Platform Pack . . . . 129.
2748 ◉ cc:mail Windows Platform Pack 335
2749 ◉ cc:mail 25 user Pack . . . . . 399.

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[illegible]—Your single solution for working in Windows. SmartSuite includes four full-featured, powerful business applications—*1-2-3 for Windows, Ami Pro, Freelance Graphics* and *cc:Mail*, all at a great price. $469.

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8137 ☐ Office 2.0 for Windows 479
1620 ☐ MS-DOS 5 Upgrade . . . . . 49.
1624 ◉ Visual Basic 1.0 129
Multisoft ... NCP
4925 ◉ PC-Kwik Power Pak w/Power Disk . . . . 79.
Niles & Associates ... NCP
3880 ◉ EndNote Plus 1.0 . . . . . 149.
Nolo Press ... NCP
5122 ◉ For The Record 2.0 . . . . . 35.
2982 ◉ WillMaker 4.0 . . . . . 39.
Norton-Lambert ... NCP
2753 ☐ CloseUp for Windows & DOS Dual Pack 129.
Novell ... NCP
4000 ☐ Netware Lite 1.0 . . . . . 69.
Okna ... NCP
9696 ◉ Desktop Set 3.0 for Windows . . . . . 79.

Panacea ... NCP
2413 ☐ WinSpeed 1.0 *(Windows accelerator)* 55
PC Globe ... NCP
5902 ◉ PC Globe 5.0 . . . . . 39.
5900 ◉ PC USA 2.0 . . . . . 32.
Personics ... NCP
9288 Laptop UltraVision 2.1 *(3½" only)* 59
4384 ◉ Desktop UltraVision . . 59.
Polaris Software ... NCP
4395 ◉ PackRat 4.0 249
PowerUp! ... NCP
7860 ◉ Calendar Creator Plus 4.0 52
Qualitas ... NCP
7539 ☐ 386MAX 6.0 59
7967 BlueMAX 6.0 for PS/2 *(3½" only)* 79
Quarterdeck ... NCP
3221 ☐ Expanded Memory Mgr 386 6.0 . 59
4586 ☐ DESQView 386 2.4 . . 129.
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4155 ◉ RightWriter 5.0 54
Reality Technologies ... NCP
6572 ◉ WealthBuilder 1.1 95
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7483 ◉ Grammatik V 1.0 for Windows 55
Roykore ... NCP
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8162 ◉ ABC Flowcharter 1.1 189
Sitka ... NCP
6675 ☐ TOPS Network Bundle 3.0 159
3720 Flash Card *(hardware)* . . . . . 155.
Software Publishing ... NCP
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4403 ☐ Harvard Graphics 1.0 for Windows . . . 399
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Spinnaker ... NCP
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Stac Electronics ... NCP
1409 ◉ Stacker 2.0 85
3524 ◉ Stacker 2.0 w/16-bit Coprocessor Card 185
Strategic Mapping ... NCP
4620 ☐ Atlas Pro 1.01 699
Symantec ... NCP
3784 ☐ The Norton Backup 1.2 for Windows 84
3146 ☐ The Norton Utilities 6.0 . 115.
3425 ☐ Q&A 4.0 249
7999 ☐ Norton Anti-Virus 2.0 84
2359 ☐ The Norton Desktop 2.0 for Windows 99
4431 ☐ Norton Desktop 2.0 & Windows 3.1 . . 165
8378 ☐ Norton PC Anywhere IV 4.5 119

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9847 ▣M.Y.O.B. for Windows ... 139
TIMESLIPS ... NCP
5037 ☐TimeSheet Pro for Windows ... 135
5698 ▣TimeSlips Release 5 ... 189.
Timeworks ... NCP
6253 ▣Publish-It! 2.0 ... 85.
Tool Technology ... NCP
3863 WinTools 1.0 for Windows *(3½" only)* ... 119
Touchstone Software ... NCP
7420 ▣Check It 3.0 ... 85.
Traveling Software ... NCP
4407 ▣LapLink Pro 4.0 ... 95.
WordPerfect Corporation ... NCP
4214 ▣WordPerfect Office PC ... 89.
3804 ☐WordPerfect 5.1 ... 269.
3494 ☐WordPerfect 5.1 for Windows ... 279.
Wordstar ... NCP
5148 ☐Wordstar 7.0 for DOS ... 269.
3442 ▣Wordstar 1.0 for Windows ... 279
XTREE ... NCP
6161 ▣XTree Gold 2.5 ... 95.

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5594 ▣Sprout 1.0 *(May '92)* ... 35.
5591 ▣Everybody's Planner 2.0 ... 49.
3629 ▣Design Your Own Home-Architecture 3.0 49.

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4388 ☐SimAnt from Maxis ... 39.
4411 ▣SimEarth for Windows from Maxis ... 45.
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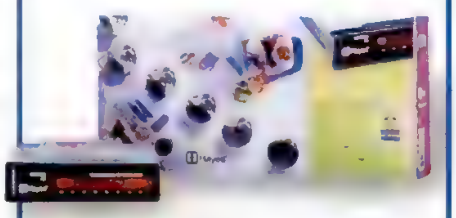
3947 ▣Math Blaster Plus ... 29.
4183 ▣KidWorks ... 29.
Electronic Arts ... NCP
4534 ▣Mavis Beacon Teaches Typing 2.0 *(CP)* 35.
3031 ▣Mavis Beacon for Windows ... 45.
3023 ▣ChessMaster 3000 ... 35.
3032 ▣ChessMaster 3000 for Windows ... 39.
Harvard Associates ... NCP
2324 ▣PC Logo 4.0 ... 59.
HyperGlot Software ... NCP
(French, German, Italian, Spanish available.)
☐Word Torture for Windows ... ea. 34.
☐Word Torture 3.0 ... ea. 29.
ICOM Simulations ... NCP
3717 Sherlock Holmes, Consulting Detective *(CD)* 39.
Knowledge Adventure ... NCP
1483 ▣Sports Adventure 1.0 ... 55.
3861 ▣Knowledge Adventure 1.0 ... 55.
Microsoft ... NCP
7881 ☐Entertainment Pack I for Windows ... 29
4079 ☐Pack II ... 29. 4077 ☐Pack III ... 29
2858 ☐Flight Simulator 4.0 ... 39.



Hayes ... 2 years
1345 *OPTIMA 24 Modem*—An affordable high-speed V.42bis modem with the reliability and quality that made Hayes famous. Supports throughput up to 9600 bps. Incl. Smartcom EZ communication software ... $155.

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3193 ☐Police Quest III *(VGA)* ... 45.
Software Marketing Corp. ... NCP
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Software Toolworks ... NCP
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5032 Miracle *(piano teacher) (incl. kybd.)* ... 325.
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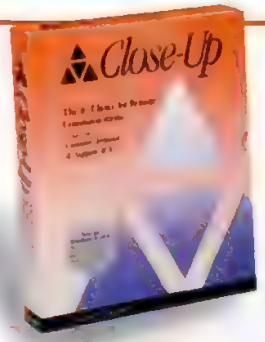
4834 ▣Super Tetris or 4833 for Windows ... ea. 29.
Toyogo ... NCP
5138 ▣Go Master Deluxe 5 0 for Windows ... 99
5143 ▣Go Master Deluxe 5.0 ... 99.
True BASIC, Inc. ... NCP
▣Kemeny/Kurtz Math Series ... ea. 45.
Walt Disney Computer Software ... CP
2629 ▣Mickey's 123's ... 29.
2624 ▣Mickey's ABC's ... 29.
4398 ▣The Animation Studio ... 79.
4416 Sound Source ... 29.



Norton-Lambert ... NCP
2753 ☐ *Close-Up for Windows & DOS Dual Pack 4.0*—*PC Magazine*'s Editors' Choice for controlling PCs miles away by modem. *PC World*'s "Best Buy" for remote communications ... intro. price until 6/30/92 $129.

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7108 Smart UPS 400 ... 339.
7105 Smart UPS 600 ... 439.
3858 Back-UPS 400 ... 179.
3823 Back-UPS 600 ... 295.
Appoint ... limited lifetime
2469 Thumbelina PC ... 62.
2480 MousePen Pro PC ... 62.
ATI Technologies ... 2 years
9821 VGA Basic-16 *(640 x 480, 16 colors)* ... 65.
9985 VGA Integra *(1024 x 768, 16 colors)* ... 89.
2706 VGA Wonder XL *(with 1 MB)* ... 199.
2382 Graphics Vantage VGA *(with 1 MB)* ... 299.
9822 8514/Ultra *(with 1 MB) (requires VGA)* ... 399.
2012 Graphics Ultra with VGA *(with 1 MB)* ... 479.
1825 2400etc/i Modem *(with 9600 SendFax)* . 109.
9620 9600etc/e Modem ... 369.
3902 Stereo•F/X ... 145.
3900 VGA Stereo•F/X *(w/512K, upgrd. to 1 MB)* 279.
Boca Research ... 5 years
7150 BOCARAM/AT PLUS *(2 MB)* ... 189.
7139 *(4 MB)* ... 279. 7138 *(8 MB)* ... 459.
6998 I/O Board for AT ... 49.
6999 I/O Board for Microchannel *(S/S/P)* ... 95.
8380 BasicVGA *(256K, 640 x 480)* ... 49.
8381 SuperVGA *(1 MB, 1024 x 768)* ... 115.
3859 2400 Internal Modem *(V.42, MNP Level 5)* 85.
2502 2400 Baud Internal Modem ... 49.
4001 2400 Baud External Modem ... 59.
Bravo Communications ... 2 years
7400 2 Position Laser Compatible Switch Box. 109.
Brown-Wagh ... 1 year
8578 Creative Labs Sound Blaster ... 109.
2336 Creative Labs Sound Blaster Pro ... 189.
Caere ... 1 year
8158 Typist Plus Graphics ... 389.
Canon ... 1 year
We are an authorized Canon Service Center.
7894 BJ-10ex Printer *(4.6 lb.)* ... 329.
7897 BubbleJet Ink Cartridge *(BJ-10ex)* ... 23.
7896 BJ-10ex Sheet Feeder ... 75.
Cardinal ... 1 year
2719 MB2296SR Internal Send/Receive Fax .. 95.
1132 386-SX-16 Motherboard ØK ... 215.
1197 386-SX-25 Motherboard ØK ... 239.
1480 Cardinal 9600 Internal Modem ... 265.
2783 Cardinal 9600 External Modem ... 299.
CH Products ... 1 year
7935 Game Card III Auto .. 33. 7341 MCA .. 49.
7340 FlightStick ... 45.
CoStar ... 1 year
1418 AddressWriter ... 479.
1947 LabelWriter II ... 185.

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Intel ... 5 years
Intel SatisFAXtion Modems–Fax from Windows or DOS as easily as you print. In 4 different performance ranges and prices. All include FAXability software ..... **see line listings.**

COVOX ... 1 year
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Curtis ... lifetime
1708 Ruby-Plus SPF-2+ ..... 65.
7358 Command Center SPF-4 ..... 89.

Cyrix Corporation ... 5 years
MATH COPROCESSORS
9875 FasMath 83D87-25 ..... 159.
9876 FasMath 83D87-33 ..... 169.
9877 FasMath 83S87-16 *(SX compatible)* ..... 99.

Epson ... 2 years
We are an authorized Epson Service Center.
5555 AP-3250 *(80 col., 200 cps, 24 pin)* ..... 239.
1906 FX-850 *(80 col., 264 cps, 9 pin)* ..... 319.
1904 FX-1050 *(136 col., 264 cps, 9 pin)* ..... 449.
2358 LQ-570 *(80 col., 252 cps)* ..... 289.
2361 LQ-870 *(80 col., 330 cps)* ..... 489.
2357 LQ-1170 *(136 col., 330 cps)* ..... 669.
5184 LX-810 *(80 col., 180 cps, 9 pin)* ..... 185.

Hauppauge Computer ... 1 year
9034 33 MHz 386N Motherboard for AT *(1 MB)* 789.
3670 33 MHz 486 Motherboard for AT ..... 1229.
4008 Win/TV ..... 439.

Hayes ... 2 years
7391 ULTRA 96 Modem ..... 669.
5024 ULTRA 144 Modem ..... 799.
1345 OPTIMA 24 Modem ..... 155.
3522 OPTIMA 96 Modem ..... 389.
9884 Pocket Edition 2400 ..... 119.

Hewlett-Packard ... 1 year
3175 DeskJet 500C *(color) (with toner)* ..... 749.
3957 LaserJet IIP Plus *(with toner)* ..... 879.
9993 LaserJet IIIP *(with toner)* ..... 1099.
6754 LaserJet III *(with toner)* ..... 1599.

Intel ... 5 years
3864 14.4EX Modem ..... 549.
7880 9600EX Modem ..... 469.
1086 Matched Memory Classic Memory Brd. ØK 139.
5990 SatisFAXtion Model 100 ..... 99.
5992 SatisFAXtion Model 200 ..... 299.
5994 SatisFAXtion Model 400 ..... 399.
5995 SatisFAXtion Model 400E ..... 459.
5999 ▣FAXability Plus ..... 79.
8903 Matched Memory 4 MB *(PS/2)* ..... 199.
Matched Memory *(for LaserJet IIP, III, IIIP IIID)*
1810 1 MB ..... 89. 1787 2 MB ..... 149.
3076 Snap-In 386 *(for PS/2 50/60 & IBM AT)* .. 389.
MATH COPROCESSORS
4750 80387SX *(16 MHz 80386SX CPU's)* .... 129.
6830 80387SX-20 *(20 MHz 80386SX CPU's)* . 139.
5409 80387DX ..... 219.

Kensington Microware ... 1 year
Full line available. Partial listing.
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2582 Master Piece Plus 99
2587 Master Piece Remote ..... 105.
7899 Expert Mouse *serial* .. 99. 7900 *bus* .. 115.
3311 MasterStand ..... 59.
3312 LaserStand *(for HP LaserJet)* ..... 125.

Keytronic ... 3 years
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Kraft ... 5 years
5800 3 button Thunder Joystick ..... 29.

Logitech ... limited lifetime
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2343 Trackman Portable 99
7975 ScanMan 256 ..... 269.
1322 FotoMan *(camera for your PC)* ..... 549.
4727 Kids Mouse 45
3295 MouseMan *(combo)* 69. 9766 *(cordless)* 89.

Megahertz ... 5 years
3020 T224FM 96/24 Pocket Fax Modem .... 249.
1187 T324FM 96/24 Fax Modem *(Toshiba Lptps.)* 269.

Micron Technology ... 2 years
7595 2 MB Expansion for HP LaserJet IIP or III 119.

Pacific Data ... 1 year
5729 ☐*Pro Tracer*–A Printer/Plotter capable of producing fast laser quality A to C-size (17" x 22") CAD drawings & impressive text documents all at a breakthrough price $1099.

Microsoft ... lifetime
7597 Microsoft Mouse *(bus or serial)* 85
2897 Mouse with Paintbrush *(bus or serial)* 99
2898 Mouse with Windows 3.0 *(bus or serial)* . 149.
1896 Ballpoint Mouse *(serial only)* ..... 119.

MicroSpeed ... 1 year
2763 MicroTRAC *(serial & PS/2 interface)* 57
6330 PC-TRAC Trackball *(PS/2)* 75
6007 *serial* ..... 75. 6008 *bus* ..... 89.

Microtek ... 1 year
2736 ScanMaker 600G *(gray-scale scanner)* .. 759.
2739 ScanMaker 600Z *(color scanner)* ..... 1249.

Mouse Systems ... lifetime
3213 PC Trackball II *(serial)* . 65 5609 *(bus)* . 77.
7878 PC Mouse III *(serial)* .. 69. 7877 *(bus)* .. 79.
5613 Little Mouse/PC *(serial)* . 69 5601 *(bus)* . 77.
5978 PenMate ..... 209.
5979 NewPoint ..... 79.

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NEC ... 2 years
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3651 CDR-73M CD-ROM Drive ..... 589.
2478 CD Gallery with CDR36 for PC ..... 579.
4252 Multisync 3FGX Monitor *(14")* ..... 689.
4249 Multisync 4FG Monitor *(15")* 799

Okidata ... 1 year
We are an authorized Okidata Service Center.
5093 OL400 Page Printer *(4 ppm)* ..... 649.
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3025 Toner Cartridge ..... 25.

Orchid Technology ... 4 years
7863 ProDesigner VGA IIS *(with 1 MB, includes RAMDAC chip)* 189
4071 Fahrenheit 1280i with 1 MB ..... 299.

Pacific Data ... lifetime/60 day MBG
5072 25 Cartridges in One! *(for DeskJet 500)* 105
6779 25 Cartridges in One! *(LJ II, IID, IIP, III, IIID)* 269.
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7055 *2 MB* .... 139. 7759 *4 MB* .. 245.
Memory upgrade for LaserJet II/IID:
6838 *2 MB* .... 245. 6836 *4 MB* ..... 359.
7158 Pacific Page PE *(LJ IID, IIP, III, IIID, IIIP)* . 299
9833 Pacific Page XL *(w/accelerator board)* .. 699.
3388 Pacific Page PE w/2 MB ..... 399.

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6009 *OmniLink Laser*–Automatically recieve and print fax messages on plain bond paper with your laser printer. Your PC does not even need to be on ..... $425.

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	REPLACEMENT POWER SUPPLIES	
3203	Turbo Cool 200	149.
7915	Turbo Cool 300	159.
	Practical Peripherals ... lifetime	
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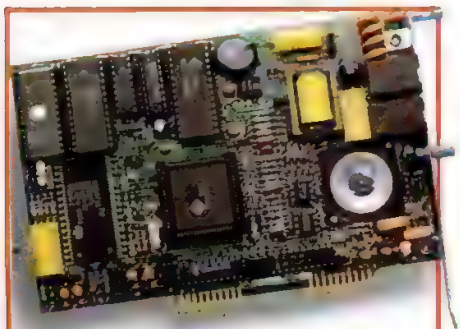
3102	2400 Baud External Modem	99.
8993	2400 Baud Internal Modem *(V.42 bis)*	115.
8994	2400 Baud External Modem *(V.42 bis)*	125.
8132	PM2400 Pocket Modem	109.
2266	PM9600 Internal Modem	275.
7934	PM9600SA Modem	289.
2264	PM2400FX96 *(int. modem/fax)*	95.
1344	PM2400FX96SA *(ext. modem/fax)*	99.
3803	PM14400FX96 *(int. modem/fax)*	359.
2425	PM14400FXSA *(ext. modem/fax)*	399.
	Prometheus ... 2 years	
1222	ProModem Ultima Home Office	489.
6009	OmniLink Laser	425.
	Targus ... lifetime	
1305	Universal Notebook *(computer case)*	69.
	TheComplete PC ... 2 years	
5828	TheComplete Communicator	299.
	Tripp Lite ... 2 years	
6199	Isobar 4-6 *(4 outlets, Gold Seal Warranty)*	49.
6200	Isobar 6-6 *(6 outlets, Gold Seal Warranty)*	59.
6201	Isobar 8-12 *(8 outlets, Gold Seal Warranty)*	69.
5549	BC400 Battery Backup	169.
	Video 7 ... 7 years	
9768	VRAM II VGA 1 MB	329.
	Zoom Telephonics ... 7 years	
1307	Int. 2400 Baud w/9600 Baud Fax Modem	99.
1178	Ext. 2400 Baud w/9600 Baud Fax Modem	99.
1181	2400 Baud V.42 bis Modem *(2 year)*	115.
3574	Ext. 2400 Baud V.42/9600 Baud Fax	145.
3386	FaxModem AFC *(2400 baud modem, 9600 send, 4800 receive fax)*	69.
4430	FaxModem AFX	79.
4429	FaxModem V.32bis *(internal)*	259.
4428	FaxModem V.32bis *(external)*	289.



Prometheus ... 2 years
1222 *ProModem Ultima Home Office*–Integrated system of data, fax & voice. 14,400 bps data modem with V.42bis/MNP 5 data compression & error correction, plus 9600 bps send/receive fax, & full voice capability ..... $489.

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	Colorado Memory Systems ... 1 year	
4194	Jumbo 120 Tape Backup	199.
4354	Jumbo 250 Tape Backup	269.
	Conner Peripherals ... 1 year	
2339	CP30104 120 MB IDE HD *(19 ms)*	399.
1337	CP3204 200 MB IDE HD *(16 ms)*	599.
	IOMEGA ... 1 year	
	We are an authorized Iomega Service Center.	
2224	Bernoulli II Transportable 90 MB	799.
2616	Internal 90 MB Bernoulli	799.
2500	PC2B Controller	199.
2530	90 MB Cartridge	149.
2467	90 MB Cartridge Tripak	439.
	Mountain Network Solutions ... 2 years	
2917	40-120 MB Internal Tape Drive	$259.
3812	FS8500 IDE Tape Backup *(304M)*	569.
6153	DC2120 Tape Cartridge *(5 pack)*	149.
	Pacific Rim ... 1 year	
1304	1.2 MB External *(for any parallel port)*	239.
2761	1.44EX MB External *(for any parallel port)*	239.
	Quantum ... 2 years	
8304	Plus Hardcard II XL 50 MB *(9 ms)*	299.
8287	Plus Hardcard II XL 105 MB *(9 ms)*	449.
4060	105 MB Drive Kit for MC PS/2's *(13 ms)*	789.
	TEAC ... 1 year	
6951	1.2 MB Drive for AT	65.
4670	1.44 MB Drive for PC/XT *(3½")*	59.
4326	1.44 MB Drive for AT *(3½", w/Bastech)*	79.
4951	720k Drive for PC/XT *(3½")*	55.
4414	3½"/5¼" Dual Floppy Drive	165.

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6556	256k DRAM *(100 ns, set of 9)*	19.
5510	1 MB x 9 SIMMs *(80 nanosecond)*	45.
2497	4 MB x 9 SIMMs *(80 nanosecond)*	169.
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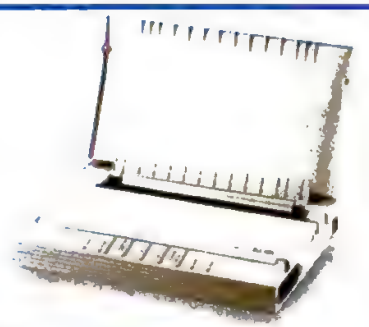

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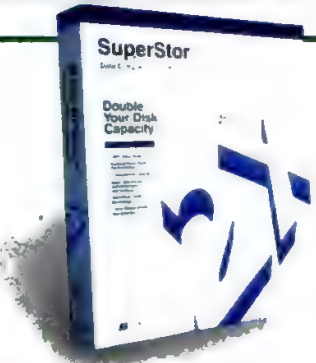

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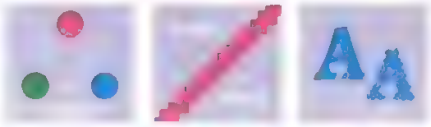

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Capture and Conversion The Windows Way

PHOTOGRAPHY: THOM O'CONNOR

Successfully incorporating images into your documents can be a daunting task when you're faced with today's bewildering array of file formats and Windows-supported screen resolutions. These ten programs will help your PC beat the bitmap blues.

by Michael Antonoff and Lori Grunin

Bitmaps make strange bedfellows. It always seems that whichever file format your image is in, this is the only format that your application can't import. Or worse, your application *says* it will import that format (TIFF is TIFF, right?), but you still get a confounding error message declaring an "Invalid File Format." What your application's documentation rarely tells you is that flavors of TIFF are like snowflakes: No two are alike. If the documentation tells you that it can import Aldus TIFF files, for example, what are you supposed to do with a *Picture Publisher* TIFF file?

Screen capture is no less a problem than format conversion. If you regularly capture screens for manuals, reports, slide shows, or multimedia presentations, a robust capture program is essential for

producing the image you need. Ironically, while Microsoft Windows is far more flexible than DOS for working with graphics, capturing Windows' screens can be terribly confusing. For instance, under DOS you have no choice but to take a picture of the full screen; under Windows, several things tend to be going on at the same time, and you might want to grab only a partial screen. Another problem with capturing Windows screens plagues documentation writers: When the capture program is at work the cursor, which just happens to be pointing toward the menu option you're trying to explicate, disappears for the duration of the shot.

Finally, Windows lacks DOS's ability to *dump* the screen to the printer—a feature that comes in very handy as a quick-and-dirty way to print text and images.

WHAT WINDOWS ALONE CAN DO

You may be surprised to find out that Windows 3.0 has a built-in screen-capture facility. It gives you two capture choices: Hitting the PrtSc key places the full screen image in the Windows Clipboard, while Alt-PrtSc captures the active window. Unfortunately, this is a rather bare-bones operation; the only indication that Windows is capturing an image is that the pointer blinks. The image is neither saved nor printed; it's simply placed temporarily in the Windows Clipboard, and if you capture another image, you lose the first one.

In order to save the image, you need to open a program that has a paste command and can accept the Clipboard's format—the Windows Paintbrush accessory, for example. Once pasted in, the image can be printed and saved. However, Paintbrush is hardly ideal, since it sometimes lops off the bottom or side of the image. Nevertheless, since Paintbrush comes with Windows, it's the default program for pasting in a screen capture. It also allows you to crop the image, save it as a .PCX or monochrome 16-color, 256-color, or 24-bit bitmap file, and even enlarge or reduce the image size for printing.

THE PROBLEM SOLVERS

The latest generation of Windows screen capture and conversion utilities, which range in price from $49 to $149.95, take different approaches to make up for the deficiencies in Windows' native abilities. These programs all capture the screen as a bitmapped image, saving the image in any one of a number of standard file formats. Most of them give you the option of capturing the full screen, the active window, or the client area (the active window without its title and scroll bars); some allow you to capture a user-defined region.

A few of these products add the ability to do basic but useful image processing, such as standardizing on a particular color palette, modifying brightness and contrast, rotating, resizing, flipping, or inverting the image (changing it into a negative). The real time-savers allow you to process groups of images.

Among the most useful capabilities of a conversion program are color reduction—intelligently decreasing the number of colors in the image—and mapping colors to particular shades or patterns of gray for monochrome printing. The ability to use the Windows palette in color reduction can be very important when images are to be displayed in Windows-based screen shows or programs limited to the Windows palette.

Most of the vendors stress that you should use a display adapter that supports more than 16 colors when using these packages. As a rule, they tend to display images poorly in 16-color modes. Unfortunately, since 32,000- and 16.8 million–color drivers are not as standardized as their vanilla VGA counterparts, many of

OUR CONTRIBUTORS

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Michael Antonoff is a free-lance writer.

RATING THE PRODUCTS: SUITABILITY TO TASK

In this group of utilities with disparate strengths, *HALO Desktop Imager* distinguishes itself as a jack-of-all-trades and master of some. But you may want to choose two or three programs whose capabilities complement each other instead.

The program's facilities for **color manipulation** include its flexibility for color reduction, the quality of its conversion from color to gray-scale images, and the intelligence exhibited when converting from gray-scale images to black and white.

The most important considerations for **file conversion** are the breadth of formats supported and the quality of conversion from one format to another; the ability to process groups of files is a plus.

Some factors to consider when assessing the program's **image processing** include basic controls over brightness and contrast, color and gray-scale correction, palette inversion, and image scaling, rotating, and flipping. Some products also provide more advanced processing functions, such as sharpening and softening.

When **printing** images from these packages, you should at least be able to position the image on the page and get fairly attractive output from a 300-dot-per-inch laser printer for both color and gray-scale images. Beyond that, look for control over various dither patterns and line-screen frequencies, as well as the ability to annotate images with text and borders.

The **screen capture** facilities of the best programs have very flexible controls for designating capture areas. They also offer customizable capture configurations, especially for capturing to a variety of file formats via user-defined hotkeys.

SUITABILITY TO TASK: Product Name	
Color manipulation	●○○○
File conversion	●●○○
Image processing	●●●○
Printing	●●●●
Screen capture	N/A

1—Poor
2—Satisfactory
3—Good
4—Excellent
N/A—Not applicable: The product does not perform this task.

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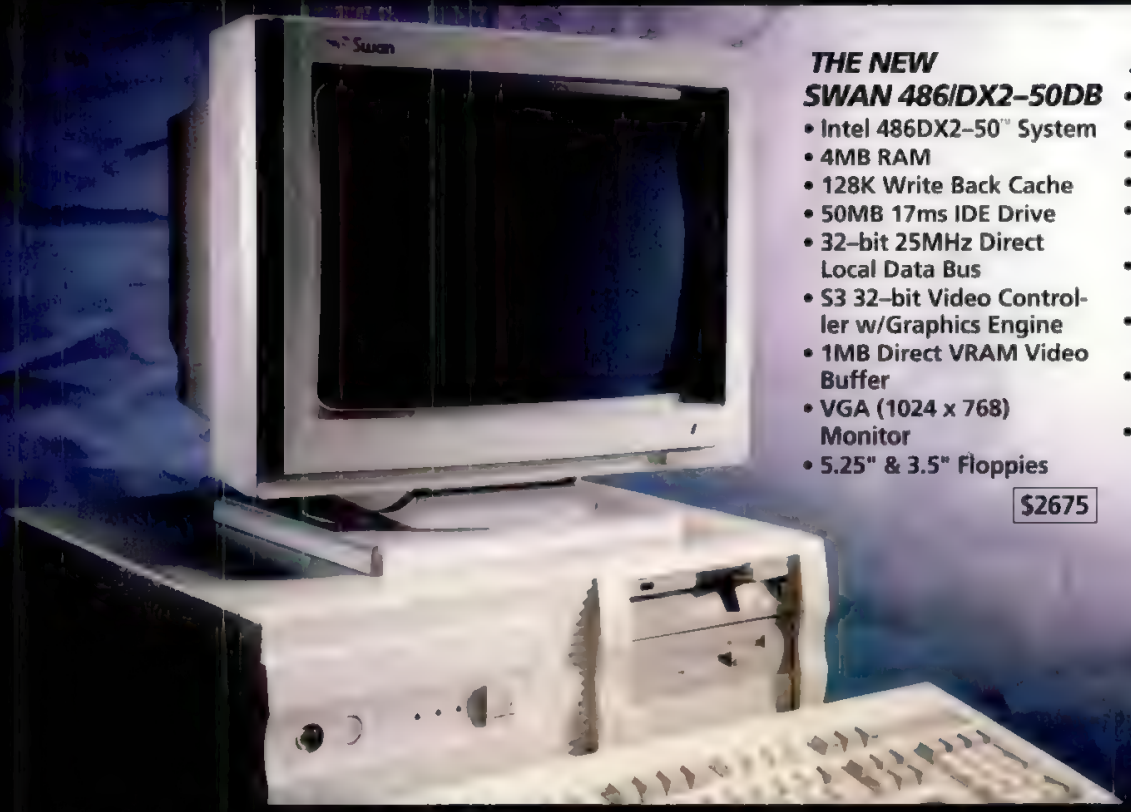

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DOS OR WINDOWS? Use the Right Tool

by Robin Raskin

DOS screen-capture and conversion tools, such as *HiJaak*, Version 2.1, and *Collage*, Version 3.1, are alive, well, and in some cases better suited to the task than Microsoft Windows image-capture utilities. Here are some rules of thumb on when to use each type.

REASONS TO USE DOS-BASED IMAGE CAPTURE TOOLS

1. Extended-mode text applications. DOS image capture is your best bet for applications using extended text modes, such as *Lotus 1-2-3* (with 132-column screens), which Windows does not fully support.

2. Low color resolution. If you are capturing images from older .CGA systems or capturing two-bit (four-color) images, you can trick DOS systems into performing a capture and then view it by specifying the destination file as a 16-color file. Windows systems will go through the motions of capturing the image, but they are unable to view it.

3. Certain desktop publishing chores. When you convert a color image to black and white or gray-scale, Windows packages use a specified color-mapping strategy. Many DOS image-capture programs let you remap the colors on an individual basis for optimal results.

4. DOS-based graphics applications. If your image source and your destination are a DOS program, then it doesn't pay to invoke Windows to do the capture. You will shortcut the process by capturing in DOS.

5. When what you see is what you capture. Because you can have multiple windows on-screen at once, you always run the risk of capturing the wrong screen or the wrong portion of a screen. Since DOS-capture programs work as TSRs, they don't appear on the screen at all; there is no room for error.

6. Automating the conversion process. The DOS command line is still the fastest way to perform a series of file conversions. Most Windows image-capture packages are not very strong in their automation features.

REASONS TO USE WINDOWS-BASED IMAGE CAPTURE TOOLS

1. Multitasking. With Windows you can convert files in the background and continue with productive work in the foreground.

2. Control over portions of the screen. Windows lets you snap the active window, a specially marked region, the whole screen, and many other variations.

3. Viewing "before" and "after" images simultaneously. Some Windows-based capture programs let you view the image before and after file conversion to make sure that you've got what you need.

4. Modifying images. The Windows environment lends itself well to working with groups of tools. For example, in Windows it's trivial to open up Paintbrush and annotate a screen capture. Trying to accomplish a similar feat in DOS requires several more steps.

5. Memory. Since DOS-based capture programs run as TSRs, they eat up conventional memory that the application you wish to capture may need in order to run; as applications become increasingly memory-needy, even capture programs that can load into expanded memory may cause problems. Windows applications generally don't face the same constraint.

6. Windows-based applications. While there are DOS utilities that can capture Windows screens, it usually doesn't make sense to run a TSR underneath Windows in order to capture the screens. ■

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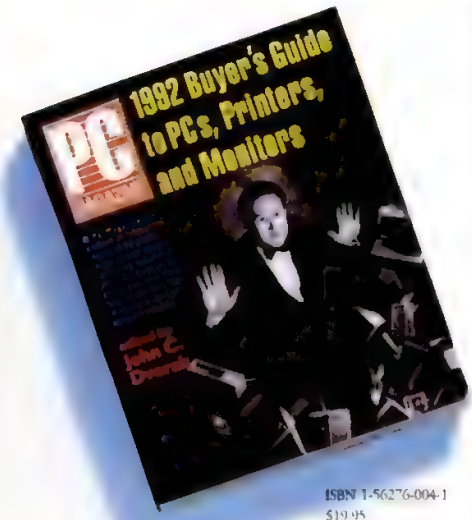

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the vendors also refuse to guarantee compatibility in those modes. That doesn't mean, however, that the products won't work at these resolutions, so if you need greater color support you might want to call a few vendors and ask about compatibility with your specific graphics adapter. Overall, 256-color mode seems to be the safest bet.

Mapping to gray scales is especially important if your target application merely dumps an image to the Windows print driver when printing. While the driver does a perfectly serviceable print job, fine-tuning the image in advance can yield superior results.

Keep in mind also that simply converting an image from gray to monochrome and importing into a desktop-published newsletter may not yield the high-quality output you thought it would: If the dither pattern you've chosen during the image-conversion process conflicts with the dither pattern specified by the DTP program's driver, you will get distracting printing artifacts known as *moiré patterns.* So the flexibility the program offers for modifying any of its features can be extremely important.

Each of the programs reviewed here captures all or a portion of a screen image; most offer a reconfigurable hotkey. There may be more than one active hotkey. For extra flexibility, *FullShot* lets you set up to four active hotkeys for various configurations of screen real estate. To capture any rectangular area of the screen, a majority of these programs provide a stretchable marquee; releasing the mouse button once the crosshairs enclose a particular area causes the program to crop and capture just that area. One program, *Clip'nSave,* provides a freehand tool that lets you trace any irregular or curved area on the screen by holding down a mouse button and drawing.

All of the programs except *Clip'nSave* and *Paint Shop Pro* auto-number a filename template of your choice (such as SCREEN00.PCX, SCREEN01.PCX, and so on), so that a saved image doesn't overwrite the previous one. This feature is handy when you are doing a series of captures. All of the programs also let you set a preferred file format for saves.

For those of you who regularly perform a series of image-processing commands—reduce an image from 256 colors to 16 levels of gray, invert it, and

EDITORS' CHOICE

■ ***HALO Desktop Imager***

With respectable screen-capture and format-conversion tools, flexible printing abilities, and well-designed image-processing functions packed into an exceptionally easy-to-use interface, the $139 *HALO Desktop Imager,* Version 1.0, easily steals the show from the competition. If you want to buy only one utility, this is it.

In case one utility fails to fill all of your graphics-processing needs, several others distinguish themselves from the pack. *Conversion Artist,* Version 1.0, and *DoDOT,* Version 3.0, are strong for basic capture and conversions. *ImagePrep,* Version 4.0, adds robust image-processing capabilities to the basic capture options. The Recipe command in *PictureEze,* Version 2.0, will work well for those who repeatedly issue the same series of image-processing commands, but the program's lack of printer support and batch-file conversion and its laggard performance outside of Recipe will discourage many.

For those who like to try before they buy, the $49 *Paint Shop Pro,* Version 1.0, can't be beat. Although it's not the most full-featured of the packages, this shareware package certainly can get you started, and it might end up being all you need.

The rest of the packages suffer from limitations that make them difficult to recommend. *Clip'nSave,* Version 2.0, offers capture flexibility but lacks any capabilities beyond that. While it can perform usable screen captures, *FullShot* 1.0's format conversion and printing are not quite up to snuff. *The Juggler,* Version 1.0, needs another round with its developer for some bug fixes and a shot of adrenaline to speed up its sluggish performance. Finally, the unambitious *SnapIT!,* Version 1.2, does little more than capture and print screens.

crop it, for example—*PictureEze* allows you to cook up a *Recipe*. By loading this Recipe later, you can repeat the same series of up to 32 steps for successive images. This can be a real time-saver. *Conversion Artist* and *HALO Desktop Imager* are better suited for converting groups of images, since they let you specify groups of source and target files. While the disk reads and writes, go get coffee.

Just like Swiss Army knives, these packages come with a core set of tools—in this case, basic screen capture and file conversion—to which they add a variety of other useful features that differentiate them. When you are performing operations such as tracing the edge of an image, multiwindow support comes in handy. If you need to output screenshots on a laser printer, the ability to invert the image can be indispensable. Printing capabilities run the gamut from nothing at all to poster-size, multipage support.

LIFE UNDER DOS

It's not absolutely necessary to use a Windows-based program in order to capture the screen of a Windows application. *HiJaak,* Version 2.1, from Inset Systems (Brookfield, Connecticut) and *Collage Plus* from Inner Media (Hollis, New Hampshire) are two DOS-based terminate-and-stay resident (TSR) programs that provide separate utilities for capturing Windows screens. To go beyond capture to conversion, though, you must leave Windows and load the DOS-based program. There are certainly situations in which the DOS products prove a superior choice (see the sidebar "DOS or Windows? Use the Right Tool"), but we chose not to include them in this survey.

Inset Systems' $249 *HiJaak for Windows,* Version 1.0, the Windows-based version of the company's popular DOS-based utility, did not ship in time for this review. Like the DOS version, *HiJaak for Windows* will support conversions among an extensive list of file types—both raster and vector—as well as capture of DOS and Windows screens. It will also offer global image-enhancement tools and a variety of color-reduction techniques.

Unfortunately (or fortunately, depending on your point of view), the companies that produce these utilities are continually upgrading them; a few more supported file formats or the addition of printing capability can merit a new release. As a

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result, many of the versions we review here will be superseded by the time you read this. If you decide that one package generally suits your needs but lacks an important feature that you want, call the vendor because it may have been added. One notable upgrade, which narrowly missed our testing deadline, was Window Painters' $69.95 *SnapPRO!*, the next version of *SnapIT!*, which we review here. In addition to the abilities to capture both DOS and Windows screens, convert among a variety of formats, and perform color reduction, *SnapPRO!* provides the ability to combine bitmaps as well as control opacity. A new product that also missed our testing deadline is Computer Associates' *CA-Cricket Image*, a Windows version of the DOS-based *PHIPS*. The feature set of this $295 package most closely resembles products such as *HALO Desktop Imager* and the forthcoming *SnapPRO!*

Clip'nSave adds the ability to capture any area, as well as to capture icons and icon captions.

Other Windows-based programs that did not make it into our survey include Anderson Consulting & Software's *Tiffany Plus*, which is being phased out, and Eikon Systems' *Scrapbook Plus*, Version 2.11, for which screen capture and conversion play second lead to cataloging images into icons for visual file retrieval.

In a field as varied as this, you'll probably find that no single image-capture program has all of the features you need. The best approach may be to buy more than one; the prices are generally low enough to make this possible. As with most utilities, it's best to have a couple on hand so that you're prepared for any task.

All reviews by Michael Antonoff and Paul Murphy

Clip'nSave

In some ways, *Clip'nSave*, Version 2.0, takes Microsoft Windows' built-in screen-capture utility and goes it one better. This $79.95 program increases the number of ways you can capture and save screens over the Windows basics, and it's clearly an improvement. Unfortunately, it's not enough of an improvement.

Windows captures two ways—entire screen or active window. *Clip'nSave* adds the ability to capture any area, as well as to capture icons and icon captions. In a rare acknowledgment that not all the world is a rectangle, the program offers a freehand tool that lets you define odd shapes for capturing.

Clip'nSave also beefs up your hotkey options. With Windows you have a choice of the PrtSc button to swallow the screen whole or Alt-PrtSc to pick up the active window, but with this program you can assign either option to 144 different keys or key combinations. *Clip'nSave* has an audible countdown option that enables you to set up a screen, and it can also draw a box around each image.

***Clip'nSave*, Version 2.0**
Dynalink Technologies Inc., P.O. Box 593, Beaconsfield, Quebec, Canada H9W 5V3; 514-489-3007.
List Price: $79.95.
Requires: 286-based PC or better, 1MB RAM (4MB recommended for 24-bit images), Microsoft Windows 3.0 or later (in Standard or Enhanced mode). Mouse or compatible pointing device recommended.
In Short: *Clip'nSave*, Version 2.0, offers more ways to capture a screen and more formats in which you can save your captures than Microsoft Windows, but poor gray-scale conversions and a lack of image manipulation and batch-processing capabilities make this program tough to recommend.

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Another big improvement over the Windows standard is the variety of file formats *Clip'nSave* can recognize. You can save images in .PCX, EPS, .GIF, and TIFF formats, with options for compression and color reduction. You can also convert color images to gray-scale.

On our tests, the program faithfully reproduced the colors of our color screen capture, but when we converted this capture to gray-scale, the shades showed little diversity. Colors appeared as either black, white, or two shades of gray with little texture. In addition, the program will not dither the screen display for images that exceed your installed display adapter's color depth.

The program's default hotkey failed to capture a *Lotus 1-2-3* for DOS window, but by using the Delay Caption option, which allowed us time to make the *1-2-3* window active, we were able to capture it.

SUITABILITY TO TASK

Clip'nSave				
Color manipulation	●	○	○	○
File conversion	●	●	○	○
Image processing	N/A			
Printing	●	○	○	○
Screen capture	●	●	●	●

Clip'nSave does not offer a way to invert the worksheet image to black characters on a white background, though, so the capture was unsuitable for printing.

UNFORTUNATE SHORTCOMINGS

In some ways, *Clip'nSave* just doesn't do enough. For example, it can crop an image, but it can't change the orientation, adjust the brightness and contrast, or create special effects. It can deal with only one image at a time. Each capture blows the previous image out of the *Clip'nSave* window without warning you to save it. If you plan to create a series of screen captures, you must remember to name and save each one. Similarly, if you load a file without saving the current image, you lose it without warning.

The program also lacks any batch-processing capabilities. If you have a group of files that you want to convert or compress, you'll have to load each one and save it accordingly.

Despite support for half a dozen file formats, *Clip'nSave* falls short when it comes to saving and printing captures. It's superior to the Windows capture utility, but not by enough to recommend it.

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Conversion Artist

North Coast Software's $149.95 *Conversion Artist,* Version 1.0, is a powerful image-capture program with good file-conversion tools and a few rough edges. Its batch file facility and support for numerous formats—particularly deep-color formats—make it a good choice for those who handle a volume assortment of source files. Those with more routine needs may be disappointed.

The program offers a variety of capture options, including capture of the active window, the active application, the entire screen, a user-defined rectangle, or the window under the mouse cursor. In the case of capturing a window, you can specify just the contents or the entire window with title and scroll bars. There is no freehand option, and you are limited to using one of the function keys as the hotkey. You can choose to send captures to the Windows Clipboard or save them in one of nine file formats, using an incremental file number.

The image capture functions quite well; on our tests, the program produced properly scaled, artifact-free images. Gray-scale conversions resulted in a pleasing palette. We captured a *1-2-3* for DOS window and converted it to solid shades of gray (alternatively, a dithering option took longer to process but resulted in patterns more appropriate for multiple-bar graphs), but there was no option to change to a negative image so that the worksheet would show black characters on a white background.

SUITABILITY TO TASK

Conversion Artist				
Color manipulation	●	●	●	○
File conversion	●	●	●	●
Image processing	N/A			
Printing	●	○	○	○
Screen capture	●	●	○	○

To its credit, *Conversion Artist* imports 25 bitmap types, including non-PC formats like .IFF (Amiga/Video Toaster), .RAS (SUN Raster), and .RGB (Silicon Graphics). You can view multiple images and windows, as well as 24-bit and 32-bit color images. Another useful feature is its batch command, which makes volume conversion work a snap. This facility, which you access from the File pull-down menu, provides an easy setup box and speedy execution. The dialog box lists multiple input files in a table; arrows point to the output format, filenames, and new extensions. Converting a group of TIFF files to .PCX format is a quick and painless procedure; you are constrained to one pair of input and output file types per batch operation, though. You can further fine-tune your output by clicking on radio buttons to choose a flat or median cut and color or gray-scale, as well as to select options for dithering and compression. (A flat-cut algorithm picks a uniform distribution of colors from the original palette, while a median-cut algorithm picks the optimum colors—some of which might not even be in the original image palette—and creates a new image palette.) The program loads a file, monitors the progress of the conversion via a sliding bar, and then moves on to the next file. Be careful when executing a batch command; *Conversion Artist* does not issue a warning before overwriting a file with the same name.

PRINTING WOES

Printing may give you some problems. While you can enter a percentage well beyond 100 percent in the printer dialog box, portions of the image will be lost if the resulting enlargement does not fit entirely on the page. Unfortunately, there is no preview or tiling facility to detect this problem before you print.

Typical image-processing operations like edge detection, posterization, and rotation are conspicuously absent from *Conversion Artist.* According to North Coast Software, these features were deliberately excluded so as not to burden customers with having to buy functions they might not need. However, accessory modules that provide groups of special effects, filters, and color-separation functions should be available by the time you read this.

Anemic documentation (with only one screen illustration) contributes to the program's feel of a work in progress. For now, the program is best suited to those who can benefit from its long list of supported formats, multiple image windows, and versatile batch-processing options.

***Conversion Artist*, Version 1.0**
North Coast Software Inc., P.O. Box 343, 18A Shipley Rd., Barrington, NH 03825; 603-332-9363.
List Price: $149.95
Requires: 286-based PC or better, 2MB RAM, Microsoft Windows 3.0 or later. Mouse or compatible pointing device recommended.
In Short: *Conversion Artist,* Version 1.0, has much to make it a recommendable product, including a long list of supported formats, the ability to handle multiple image windows, and batch processing, but the lack of special effects and the skimpy documentation give it the feel of a work in progress.

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DoDOT

Halcyon Software's $149 *DoDOT,* Version 3.0, is a reasonably complete screen-capture, file-conversion, and printing program. What *DoDOT* lacks in batch-processing ability it makes up for in image quality.

You can use *DoDOT* to capture an

***DoDOT*, Version 3.0**
Halcyon Software Inc., 1590 La Pradera Dr., Campbell, CA 95008; 408-378-9898.
List Price: $149.
Requires: 286-based PC or better, 1.5MB RAM, 5MB hard disk space, Microsoft Windows 3.0 or later, mouse.
In Short: An easy-to-use interface and high-quality screen captures make *DoDOT,* Version 3.0, a worthy choice for working with multiple images.

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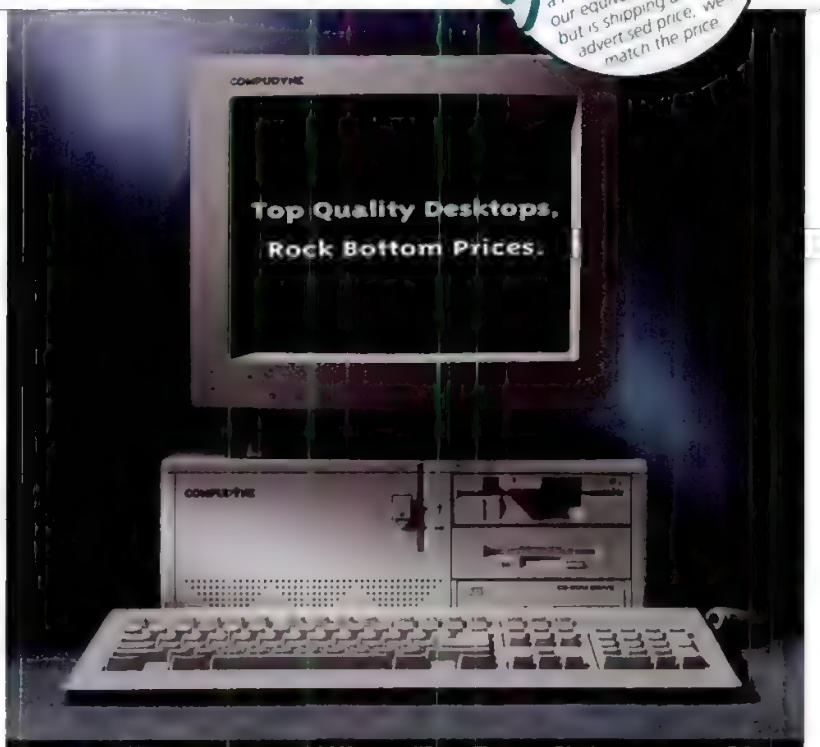

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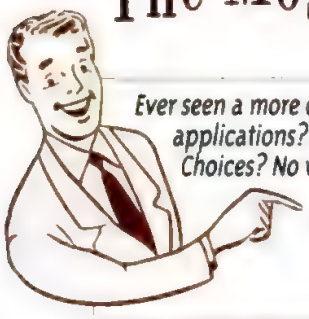

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SUITABILITY TO TASK	DoDOT
Color manipulation	● ● ○ ○
File conversion	● ● ● ●
Image processing	● ○ ○ ○
Printing	● ● ● ●
Screen capture	● ● ● ○

entire screen, a window, an area you outline, or coordinates—a particularly useful option if you regularly need to capture a fixed location. Options include the ability to send all captures to the display, printer, Clipboard, file, or any combination. You can tailor the auto-save function to save to one of nine formats with sequential numbering and a filename prefix. In addition, you can designate any function or Shift-function key (except F1) as the hotkey.

DoDOT uses the Multiple Document Interface and captures or loads new images into overlapping windows; the ability to work with multiple images is an important feature that only a few of the competing programs reviewed here support. There are 11 zoom levels, and you can step through the magnifications by pressing the left or right mouse buttons. A color control window lets you map color preferences and apply them to your image.

In our tests, *DoDOT*'s .PCX file captures were indistinguishable from the originals. But captures in 32,000-color mode under Windows 3.1 did not display and could not be read by other applications, and the color picker did not work at all in any color mode. Gray-scale conversion was true: Solid shades remained solid, and patterned samples showed the same textures. The printed result of the program's capture of a full-screen DOS window (which worked only after we set the Capture Options box for Window Under Cursor) was readable once the image was converted to gray and inverted.

PRINT OPTIONS

The Print/Option Layout box provides a way to position and resize a bare rectangle of your printable output (but not a thumbnail picture) using the mouse or coordinates to set margins. However, you can print only one image per page. You choose the print quality (proof, draft, or monochrome) here, and select dithering and color-to-gray-scale options from a separate pull-down menu. *DoDOT*'s default print image fills the width of the page and displays excellent contrast and solid tones. The program offers no halftones or special print screens.

By the time you read this, Halcyon Software should be shipping *DoDOT*, Version 4.0, for $189. The upgrade, available to owners of previous versions for $49.95, will be able to read in 13 vector file types and write to seven vector formats. For those who want screen-capture and printer output alone, the company is now selling a separate $69 package called *DoSNAP*, Version 1.0, which will be bundled with *DoDOT*, Version 4.0. *DoSNAP* includes a freehand tool and the ability to save in nine bitmap formats; in addition, *DoSNAP* can handle 24-bit captures, which *DoDOT* can't.

In our tests, *DoDOT*'s .PCX file captures were indistinguishable from the originals.

Batch conversion is the main capability missing from *DoDOT*; rotation and special-effects functions are less important omissions. If batch processing is not a major concern, however, *DoDOT*'s easy-to-use interface and high-quality output may make it the one utility to consider for multiple screen captures and file conversion.

FullShot

There's a lot to be said for no-frills products that offer only the basic features, but when even the basics don't work, the less said the better. Such is the case with *FullShot*, Version 1.0. This $99.95 package from Inbit provides only the most basic of functions wrapped in a hard-to-decipher interface.

You can capture an entire screen or any rectangle by double-clicking on a camera icon or by pressing hotkeys. To reconfigure the hotkeys, you must turn to an overbearing on-screen keyboard. But no matter how bad the interface, you'll want to do this immediately since the default triggers are three-key combinations you are not likely to remember.

The program can automatically save or print captured images with sequentially numbered filenames, using the default format and target directory you specify. Unfortunately, you have only four file format options when saving your captures. *FullShot* holds only one image at a time, but the program prompts you to save your current image before you load another, so you can't accidentally overwrite the current image.

One nice *FullShot* feature that is missing from most of its competitors is the ability to place a frame style and mat around an image. Unfortunately, the implementation is less than ideal. You are required to choose a line style and color for the frame, a mat color to fill the space between the frame and image, and the pixel thickness of each from the Frame Styles box. You'd expect the image to adjust accordingly when you click on OK, but instead you must click on the Frame command, three pull-down menus over, to force the change. If you try to make changes from the Frame Styles box, the program places a frame around the existing frame rather than altering the frame and mat already in place. Since you can't strip out the underlying frame and mat, the best you can do is crop the image back

***FullShot*, Version 1.0**
Inbit, P.O. Box 391674, Mountain View, CA 94039; 800-227-1788, 415-967-1788
List Price: $99.95.
Requires: 286-based PC or better, DOS 3.1 or later, Microsoft Windows 3.0 or later. Microsoft Windows–compatible mouse recommended.
In Short: *FullShot*, Version 1.0, offers only the most basic functions, and even those aren't particularly impressive. Screen captures are fairly accurate, but conversions can be a nightmare, and printing can be a trying experience.

CIRCLE 460 ON READER SERVICE CARD

When it comes to converting color to subtle but solid shading, *FullShot* is color-blind.

to its bare self, or clear it out of memory and start from scratch.

COLOR-BLIND CONVERSIONS

FullShot's .PCX file capture accurately saves colors and patterns. But when it comes to converting color to subtle but solid shading, *FullShot* is color-blind. Our gray-scale conversion produced checkerboards and polka dots rather than solid shades of gray. As an alternative, we tried a default monochrome conversion: *FullShot* gives you control over what color will be counted white or black through an interactive dialog, something none of the other programs do.

FullShot successfully captured and inverted the *1-2-3* window. Use of the gray-pattern command, however, resulted in text that looked like a poor carbon copy. We achieved the most readable results by converting the color image to straight black and white and then inverting it. This removed all of the gray but yielded dark, solid characters.

You align output by clicking on one of nine alignment boxes. The program includes a gray-pattern option that you can use to print a color image. We encountered a problem printing under Windows 3.1, however: *FullShot* kept misreading the printer driver and eventually crashed. The scaling command makes no sense

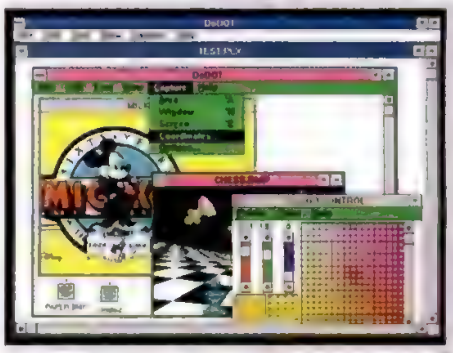
SUITABILITY TO TASK	FullShot
Color manipulation	● ● ○ ○
File conversion	● ○ ○ ○
Image processing	N/A
Printing	● ● ○ ○
Screen capture	● ● ○ ○

WINDOWS IMAGE CAPTURE: The Good, the Bad, and the Ugly

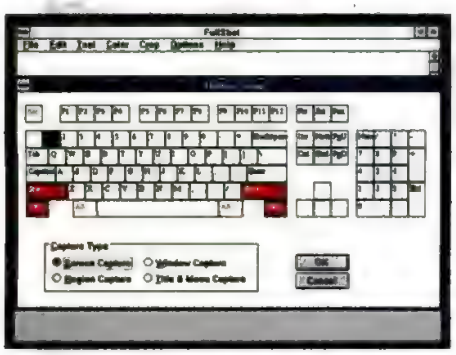
While these Microsoft Windows–based screen-capture and conversion packages tend to have different feature sets, their interfaces don't vary quite as much.

The common goal of these interfaces is ease of use. They all offer the standard Windows-style pull-down menus and dialog boxes for choosing options like which hotkey combinations to use for captures or which special effects to use when processing a batch of images. Some of the packages, like *HALO Desktop Imager*, add icon buttons and slider bars to give you greater control over image attributes like brightness and contrast. Others, like *FullShot*, choose a less common but no less familiar metaphor (in this case, the computer keyboard), and are easier to use.

Which package really is the easiest? Take a good look at these screen captures and decide for yourself.

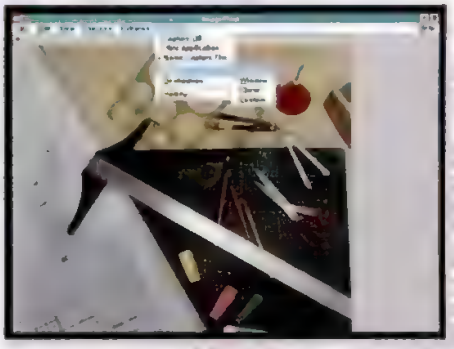


***DoDOT*, Version 3.0, can capture or load multiple images in overlapping windows. The program offers a wide variety of capture options, which you select from a pull-down menu.**



***FullShot*, Version 1.0, lets you select multiple hotkeys, but you must do so from an on-screen keyboard. You can use the program to capture an entire screen or a rectangle.**

***Conversion Artist*'s batch command makes volume conversion a snap. You choose the input and output formats, as well as compression, from the Batch box.**



***ImagePrep*, Version 4.0, lets you designate a screen, an active window, a client window, or a rectangular area that you can specify as the capture area.**

until you've done some test printouts and discover a happy medium between thumbnail- and poster-size images. The program lacks sophisticated features such as multiple active images, batch-file conversion, and 24-bit color support.

If your needs are strictly meat-and-potatoes, *FullShot* may not seem like a bad choice.

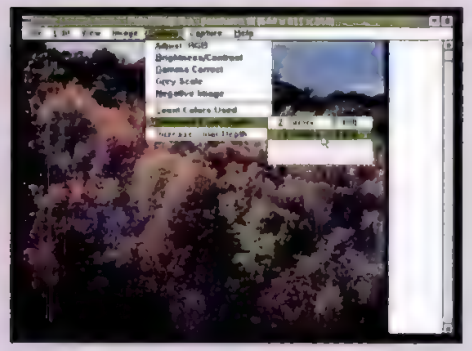
If your needs are strictly meat-and-potatoes, *FullShot* may not seem like a bad choice. But keep in mind that while the captures are fairly tasty, the conversions need a new recipe. Until the program gets an overhaul, it's tough to recommend.

HALO Desktop Imager

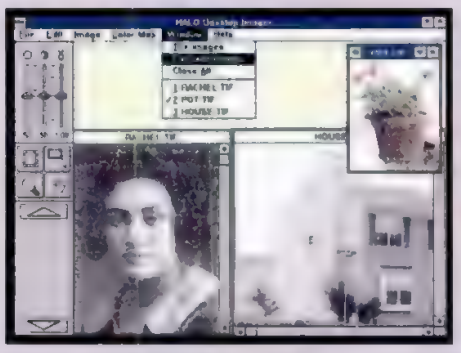
Redefining what we can expect from a graphics utility, Media Cybernetics' $139 *HALO Desktop Imager*, Version 1.0, sets a lofty standard for other products to follow. A combination of powerful image-processing functions, support for a variety of gray-scale and color scanners, and an easy-to-use interface make *HALO* nothing less than a joy to work with.

HALO exploits the Microsoft Windows MDI (Multiple Document Interface) by allowing multiple images to coexist in child windows within the workspace. Each child window can have up to three undo levels, and each undo is identified by the function performed. Any undone function in the undo queue can be reapplied. To conserve memory you can limit the number of undo levels or turn them off completely.

HALO's interface includes a toolbox containing three slider bars that adjust brightness, contrast, and gamma. Also in

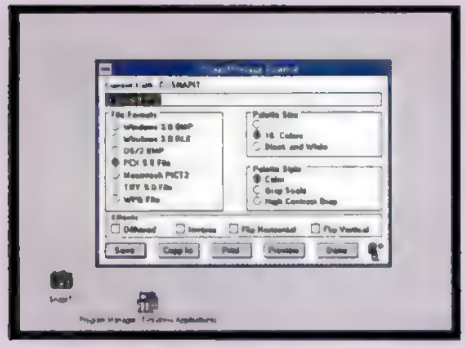


Color reduction is a snap with *Paint Shop Pro*, Version 1.0. You can reduce this 256-color image to 16 colors or to black and white with a simple menu selection.

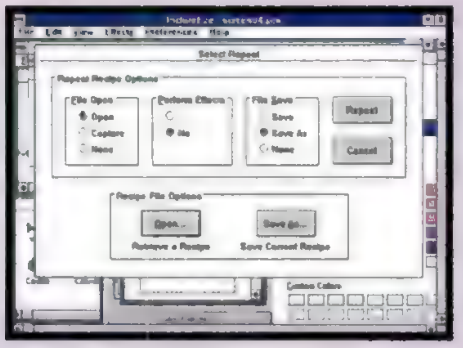


HALO Desktop Imager, Version 1.0, lets you load multiple images into separate windows. Once they're open, you can easily transform the image by using a variety of filters and effects.

Instead of working with individual images or loading multiple images into separate windows, *The Juggler*, Version 1.0, lets you overlay and merge various images on the same drawing board.



You can't view your image captures in *SnapIT!*, Version 1.2, but you can preview them through the Image Control box. Here, you can choose file format, palette, and effects.



PictureEze, Version 2.0, provides a macro-style recorder that logs up to 32 sequential effects into a Recipe. You can name, save, and load recipes separately from image files by using the Select Repeat box.

In *Clip'nSave*, Version 2.0, you choose options via hotkey functions, including automatic printing, from the Capture Options box.

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ❑—No

	Clip'nSave	Conversion Artist	DoDOT	FullShot	HALO Desktop Imager	ImagePrep	The Juggler
List price	$79.95	$149.95	$149.00	$99.95	$139.00	$149.00	$149.95
SCREEN CAPTURE							
Capture areas:							
Active windows	■	■	■	■	■	■	■
Client window	■	❑	■	■	■	■	■
DOS window	■	■	■	■	■ (windowed only)	■	■
Freehand (nonrectangular)	■	❑	❑	❑	❑	❑	❑
Full-screen	■	■	■	■	■	■	■
Icon caption	■	■	❑	■	❑	❑	■
Program icon	■	■	■	■	❑	❑	■
User-definable rectangle	■	■	■	■	■	■	■
Window under mouse pointer	■	■	■	❑	❑	❑	❑
Capture customization:							
Any key or key combination assignable as a hotkey	■	■ (function keys only)	■	■	■	■	■ (function keys only)
Time-delayed capture	■	❑	❑	❑	❑	❑	❑
Audible countdown option	■	❑	❑	❑	❑	❑	❑
Captured-image file handling:							
Automatic writes to disk	❑	■	■	■	■	■	■
Number of file formats for capture	5	15	4	4	8	6	18
Incremental numbering	❑	■	■	■	■	■	■
Automatically saves to Microsoft Windows' Clipboard	■	■	■	■	❑	■	❑
Automatic printing option	■	❑	■	■	❑	❑	■
Simultaneous print and save	❑	❑	■	■	❑	❑	❑
Capture color depths:							
16-color modes	■	■	■	■	■	■	■
256-color modes	■	■	■	■	■	■	■
32,000-color modes	Driver-dependent	■	❑	Driver-dependent	Driver-dependent	■	■
16.8 million–color modes	■	■	❑	Driver-dependent	Driver-dependent	■	■
SCREEN DISPLAY							
Full-screen image (without title bar, handles, and menus)	■	❑	❑	❑	❑	■	❑
Built-in screen show	❑	❑	❑	❑	❑	❑	❑
Fully supported display modes:							
16-color modes	■	■	■	■	■	❑	❑
256-color modes	■	■	■	■	■	■	■
32,000-color modes	Driver-dependent	■	■	❑	Driver-dependent	■	■
16.8 million–color modes	■	■	■	❑	Driver-dependent	■	■
IMAGE PROCESSING							
Number of zoom levels	1	None	11	Limited by memory	7	2	4
Number of undo levels	None	1	1	1	3	1	1
Color reduction:							
To black and white	■	■	■	■	■	■	■
To 16 gray scales	■	■	❑	■	■	■	■
To 256 gray scales	■	■	■	❑	■	■	■
Places frame or mat border around screen	■	❑	❑	■	■	❑	❑
Can load multiple images simultaneously	❑	■	■	❑	■	❑	■
Each image window maintains its own undo stack	❑	■	■	❑	■	❑	❑
User can save color palette information separately from the image file	❑	❑	❑	❑	■	❑	❑

N/A—Not applicable: This feature was not tested by the vendor.

Paint Shop Pro	PictureEze	SnapIT!
$49.00	$149.00	$69.95
❑	■	❑
❑	■	❑
■	■	■
❑	❑	❑
■	■	❑
❑	❑	■
❑	■	■
■	❑	■
❑	❑	■
❑	■	❑
❑	❑	❑
❑	❑	❑
❑	■	❑
7	25	7
❑	■	■
❑	❑	❑
❑	❑	❑
❑	❑	❑
■	■	■
■	■	■
Driver-dependent	■	❑
❑	■	❑
■	❑	❑
❑	❑	❑
■	■	■
■	■	■
■	■	❑
N/A	■	❑
20	8	1
1	1	None
■	■	■
■	■	■
■	■	■
❑	❑	❑
❑	❑	❑
❑	❑	❑
❑	❑	■

CONTINUES

the toolbox are *HALO*'s powerful frame (rectangular selection) tools. The package's wealth of special-effects filters such as sculpting, metal, posterizing, softening, edge tracing, and embossing can be applied locally within the frame, as well as globally to an image without a frame. Frames also control cropping, rotating, color inversion, and all color manipulation functions. Any framed portion of an image that receives one of these commands is converted and placed in its own child window. Framed areas copied to the Clipboard can be pasted onto any other image. Images that are iconized are stored in a unique scrollable ribbon for easy access.

HALO Desktop Imager sets a lofty standard for other products to follow.

In another nice touch, the program includes an auto-stitch feature that automatically assembles multiple strips captured by hand scanners into single images. You can also convert images between formats, reduce color depths, and apply compression algorithms to any or all images in a given directory, though the output directory must be different to ensure that no files are overwritten.

POWER PRINTING

Unique among the products reviewed here, *HALO* can display and print out test strips to check for proper output of brightness, contrast, gamma, and halftones. These test strips can prove invaluable in judging settings for images to be printed on output devices that change the way an image looks. The adjustments you make can then be saved and applied to other images to ensure consistency of image quality.

HALO has by far the best printing capabilities of all the products reviewed here. You can print images using calibration settings saved after using the test strips. The images can be printed poster-size, using up to 50-by-50 letter-size pages, and any individual pages can be printed separately by selecting them interactively with the mouse from a thumbnail representation of the poster matrix.

On a more mundane note, the capture options include automatic saves to one of eight popular formats, with incremental file numbering and the ability to change the hotkey setting. While performing a capture, you see a rather disconcerting scan line scroll down the screen, but *HALO*'s captures come out as expected.

For all this power, there are a few blemishes on *HALO*'s face. Although many formats can be opened, the File Open command recognizes only TIFF files; all other supported formats must be opened using a redundant Import command. The dithering algorithms used to display images on 16-color systems are especially bad. But despite the aesthetics, images are always saved in a format that displays attractively on 256-color or true-color systems.

PC MAGAZINE FACT FILE
EDITORS' CHOICE

***HALO Desktop Imager*, Version 1.0**
Media Cybernetics Inc., 8484 Georgia Ave., Silver Spring, MD 20910; 800-992-4256, 301-495-3305.
List Price: $139
Requires: 286-based PC or better (running at 10 MHz or faster), 640K RAM (2MB recommended), Microsoft Windows 3.0 or later, EGA graphics adapter or better (8-, 16-, or 24-bit graphics adapter recommended), mouse
In Short: *HALO Desktop Imager*, Version 1.0, combines an easy-to-use interface with a set of imaging commands as full as you're likely to find in one low-cost package. If *HALO* doesn't have it, it's a feature you probably don't need.

CIRCLE 461 ON READER SERVICE CARD

SUITABILITY TO TASK

HALO Desktop Imager				
Color manipulation	●	●	●	○
File conversion	●	●	●	○
Image processing	●	●	●	●
Printing	●	●	●	●
Screen capture	●	●	●	○

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Get PictureEze 2.0 and CaptureEze is included free! PictureEze is the Windows graphic file format converter. Use it when you need to import a graphic image into one of your Windows or DOS applications. PictureEze is easy to use. Just click on the name of the application you're using and PictureEze will automatically convert the image to the best format for your application. **Publisher: Application Techniques GR2134 $95.**

CaptureEze

CaptureEze, also available separately, is the Windows screen capture utility. It can capture the entire screen, the Active Window or the Client Area. Click on the name of your application and CaptureEze, like PictureEze, will automatically create the file format your application requires.
Publisher: Application Techniques
Also available *Pizazz Plus 3.0* **BS0204 $65.**

CaptureEze **UT2444**

$45

★WinSleuth Professional 2.0

This new version takes advantage of Windows GUI. Over 40 new features include tests on serial ports, mouse, keyboard, video adapter, RAM, and hard disk drive within the Windows environment; hard disk space utilization; low-level disk details; partition table; VGA information and memory statistics under DPMI; view DOS level info such as environment details, TSRs, I/O port usage, system resources, device drivers and task list.
Publisher: Dariana Technology Group, Inc. UT1704

$105

★FAX PAK

FAX PAK brings together WinFax PRO and FAXGrabber - giving you easy, automatic integration of faxes from your PC fax board into virtually any application. And, FAX PAK includes Norton Desktop for Windows making fax and desktop file management even easier. With Delrina's WinFax PRO, PC Magazine's "Best of 1991" you can send high quality faxes from any Windows 3 application and receive faxes in the background, from any Group 3 fax device. Then, FAXGrabber completes the fax solution by taking those incoming faxes and automatically converts them into your favorite word processing, spreadsheet or desktop publishing application for instant revision or routing via E-mail. WinFax PRO and FAXGrabber reside as icons in your Norton desktop environment, for easy access.
Publisher: Delrina/Calera FX0184

$149

Graftek 2.0

Graftek analyzes and graphs your data, performs calculus, carries out complex statistical calculations, frequency analysis (FFT), transformations and curve fits. It includes an extensive library of math and trig functions allowing you to define and plot your own functions. Graftek's Calculus Menu computes area under the curve, zeros, maxima and minima, inflections, intersections and more. The Statistics Menu computes descriptive statistics, histogram, normal distrubution, box-plot, pie chart, scatter plot, trend analysis and more.
Publisher: Artworx BS5004

$129

★PackRat 4.0

PackRat is a powerful, intuitive personal information manager (PIM) that flexibly handles your phone book, calendar, to-do's, hard disk files, projects, autodialing, reminders, finances, time management, free-form notes and more. New Action Buttons and customizable SmartButtons make PackRat work the way you work. Store multiple addresses and phone numbers and extensive notes on your contacts. Seamlessly exchange information with Word for Windows, Ami Pro and Excel. PC Magazine's Editor's Choice. Also available, *PackRat 4.0 for Networks* **BS2934 $429 Publisher: Polaris BS2894**

$259

ULTRA 96

ULTRA 96 - V.32/9600 bps advanced stand-alone modem. Dial-up or leased line operation and throughput to 38,400 bps with V.42bis data compression and V.42 error-control. Supports Express 96, Hayes Advanced Proprietary 9600, for high-speed communications with installed base of V-series products and ULTRA 24 with Express 96. Asynchronous, synchronous, and Hayes AutoSync. Automatic Feature Negotiation selects the best combination of advanced capabilities, flow control prevents inadvertent data loss, extensive V.54 diagnostic testing helps identify any problems, PABX and business line support, MI/MIC and CCITT V.25bis support, and free Smartcom EZ software
Manufacturer: Hayes MM0210

$689

SpinRite II 2.0

SpinRite II 2.0 is a non-destructive low-level hard disk reformatter. It identifies, diagnoses, and repairs every form of low-level format and data damage. If it finds a surface defect, it relocates the data to safe area, and locks out the bad areas. SpinRite also speeds up hard disk read/write operations by optimizing the interleave factor. When SpinRite is finished, it produces a fully documented disk system status report. Compatible with MFM, RLL, and ARLL encoding. Includes a head parking utility.
Publisher: Gibson Research UT0874

$65

★CorelDRAW! 2.0

CorelDRAW! 2.0 is the PC graphics software for everyone. It's fun and it's powerful, and the winner of over 40 international first place awards! CorelDRAW! gives you incredible type control, superb drawing power, and stunning special effects in a value-packed program. It comes with over 150 fully scalable outline fonts (which can be converted for use with Adobe Type Manager), over 4000 clipart images and symbols, dozens of fill patterns, dotted and dashed line styles, and Arrowheads; 31 import/export filters; a free Pantone license, and free utility programs - CorelTRACE, WFNBOSS, and Mosaic. Windows 3.0 or OS/2 required. Also available on CD ROM **CD0220 $445 Publisher: Corel Systems GR0543/5**

$369

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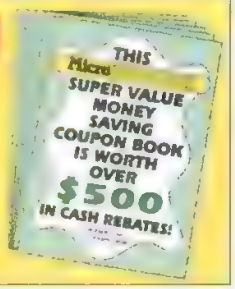

★Aldus® Gallery Effects™

Aldus Gallery Effects is a library of artistic effects that automatically transforms grayscale or color scanned photographs and other bitmap images into stunning, sophisticated works of art. Use Gallery Effects' plug-in filters directly in programs like Aldus PhotoStyler, or use the separate application. Sixteen master effects, including Graphics Pen, Watercolor, Emboss, and Charcoal. Thousands of variations from each effect. A "must have" for any scanner user. **Publisher: Aldus GR5294**

$139

Painter

Painter is a remarkable 24-bit color paint program for windows 3.0 and 3.1 that simulates the tools and textures of natural media. With painter, the eye actually sees the striated surfaces of oil paint, the saturated bleed of felt markers and the nubby richness of charcoal. Painter can be used to create original art or to apply natural media effects to scanned images. Bit Gates proclaimed Painter as one of the five most innovative products shown at Fall Comdex. The Macintosh version (now the same as Windows) won several major awards including Personal (Business) Publishing's Paint Program of the Year! **Publisher: Fractal Design Corp. GR5344**

$319

FaxMania

FaxMania is an imaginative and customizable collection of 80 ready-to-use fax cover sheets designed to work straight from the box with all popular word processors. Formats for the IBM PC include WordPerfect, WordPerfect for Windows, Microsoft Word, Word for Windows, AmiPro and many others! The cover sheets include both activities and fun events and cover the following subjects: Meetings, Finances, Announcements, Ecology, International, Reminders, Invitations, Sports, Travel, and much more... **Publisher: T/Maker GR5103/5**

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EX1940	Desktop TV VG1	299
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EX1840	BRAT90 with ØK	115
Brown - Wagh		
EX1510	MIDI Connector for SoundBlaster	59
EN0910	Sound Blaster	115
EX1800	Sound Blaster Pro	199
Digital Vision		
EX1195	ComputerEyes Prof Series	359
EX1610	ComputerEyes Color/RT	529
Media Vision		
CD0320	Multi Media PC Upgrade Kit	829
IN2550	ProAudio Spectrum 16	229
Persona Technologies		
EX2060	PC Speakers	179
Stac Electronics		
EX1480	Stacker 2 0	99

MEDIA & ACCESSORIES

Disks (boxes of 10)		
	BASF Sony Maxell and bulk Fuji	Call
Kensington		
AC0140	Masterpiece Plus	95
Targus		
AC2340	Premier Leather Case	169
AC0670	Universal Notebook Case	66

DRIVES/CD ROM

Iomega		
DR2060	Bernoulli 90MB Cartridge	145
DR1970	Bernoulli 90MB Transportable	799
DR2240	Bernoulli PC Powered	739
MicroSolutions		
DR1240	backpack 1 4	210
DR1790	backpack 2 8	249
Plus Development		
DR1250	HardCard II XL 105 MB	469
Teac		
DR0910	Teac 3 5 1 44 FD	75

PRINTERS & CARTRIDGES

Adobe		
BN0080/70	Adobe PostScript Cartridge with Type Cartridge 1 or 2	299ea
PR1314	★ATM Plus Pack	125
Canon		
PR1710	Auto Sheet Feeder for BJ-10e	72
PR1500/10	Bubble Jet BJ 10ex	325
PR2240	Bubble Jet BJ 300	459
PR2230	Bubble Jet BJ 330	599
Citizen		
PR2320	GSX-140 Plus Color Printer	339
IQ Engineering		
PR0610	Super Cartridge 2	269
PR1950	Super Cartridge 3 Pro	269
Pacific Data Products		
PR1120	25 Cartridges in One!	269
PR0910	Pacific 4 Memory w/ 2Mb	145
PR0490	PacificPage w/1 2 4 Plus 2mb	375
Panasonic		
PR2200	KX-P1124i Printer	299
PR2190	KX-P2624 Silent	469

MODEMS & FAX BOARDS

Cardinal		
MM0520	Internal 2400 Bd Modem	55
MM0870	Int. 2400 Bd Modem w/6900 Send/Rec. Fax	99
MM2070	Int 9600 Bd Modem w/V 42 BIS MNP	269
Deirina/Calera		
FX0184	★FAX PAK	149
Hayes		
CM0294	Smartcom Exec 2 1	75
MM0930	OPTIMA 96 V 32	399
MM0810	Pocket Edition 2400	119
MM0210	Ultra SmartModem 9600 V.32.	689
MM0860	Ultra 144 V 32 BIS Ext	849
The Complete PC		
FX0060	The Complete Communicator	320
FX0040	The Complete Fax/9624	245
Zoom Telephonics		
MM0690	HC2400S w/9600 Sendfax Int	95
MM0660	MX2400S w/9600 Sendfax Ext	99
MM3600	Modem V 42b s 2400 Ext	125
MM0820	V 32 Turbo 9600 Ext	349
MM0990	Zoom 9624 Send/Receive Fax	135

NETWORKING

3-Com		
NT0060	Ethernet II-Single User	199
Artisoft		
NT0110	Lantastic 2 MBPS Adapter Card	149

INPUT DEVICES

Appoint		
IN2130	MousePen Professional	65
IN2260	Thumbelina	69
Caere		
IN2314	★The Typist Plus Graphics (AT)	389
CH Products		
IN0910	FlightStick with Falcon 2 0	45
Logitech		
IN1070	Scanman 256	269
IN2250	Trackman Portable	99
Microsoft		
IN2150	Ballpoint Mouse	119
IN0890/80	Mouse (bus/ser)	85
IN0275/84	★Mouse w/Windows (bus/ser)	145
MicroTouch Systems		
IN0810	The UnMouse	165
The Complete PC		
IN2110	Complete Page Scanner w/ WordScan OCR Software	569
Z-NIX		
IN1003/5	★SuperMouse II (ser) w/Win 3 0	75

MONITORS

Various		
MT0280	PanaSync C1381 14" VGA Color	369
MT0320	Samtron Super VGA Color	329

ENTERTAINMENT & EDUCATION

Abracadata		
EN2694	Design Your Own Home Architecture	43
	Interiors Landscape	49 ea
EN2684	Design Your Own Railroad	35
Broderbund		
EN0734	SimCity	29
EN0184	Where in the USA is Carmen SanDiego	32
Entertainment On Line		
EN2014	Lottery Tracker & Wheeler 4 0	29
Microsoft		
EN1473/5	★Entertainment Pack	29
EN0043/5	★Flight Simulator 4 0	38
Personal Training Systems		
ED2323	★Excel 4 0 beginning Spreadsheets	65
ED2253	★Lotus 1 2 3 beginning Spreadsheets	65
ED3023	★Word 2 0 beginning	65
Software Marketing		
ED3034	BodyWorks	49
ED3044	Orbits	39

DESKTOP PUBLISHING & GRAPHICS

Adobe		
	Adobe Fonts (various)	Call
PR1594	★Adobe Type Manager	59
GR2094	★TypeAlign	65
GR5144	★Illustrator 4 0 for Windows	449
Aldus		
GR3043/5	★Aldus FreeHand	399
GR5034	★Aldus PhotoStyler	549
GR5294	★Aldus Gallery Effects	139
GR2053/5	★◆PageMaker 4 0	489
GR5013/5	★Persuasion 2 1	330
Application Techniques		
GR2134	★PictureEze 2 0	95
Ares Software		
GR3074	★FontMonger for Windows	98
Berkeley Systems		
GR1994	★After Dark 2 0 for Windows	29
Broderbund		
GR1564	New Printshop	35
Computer Associates		
GR1823	CA-Cricket Graph 1 3	85
Corel Systems		
GR0543/5	★CorelDRAW! 2 0	369
FontBank		
GR2823	FontBank Type Companion	99
Fractal Design Corp.		
GR5344	★Painter	319
Micrografx		
GR2783/5	★Micrografx Designer 3 1	485
GR2833/5	★Windows Draw!	105
GR5283/5	★Picture Publisher with Color Scanner	649
Micrologic		
GR1444	MoreFonts 3 0	79
Microsoft		
BS2304	★◆Powerpoint for Windows	315
GR3144	★Microsoft Publisher for Windows	129
New Vision Technology		
GR3174	★Presentation Task Force CGM 4 0	134
Ocron		
GR2184	★Perceive Personal 2 0 for DOS & Windows	119
Software Publishing		
GR2303/5	◆Harvard Graphics 3 0	415
GR5063/5	★◆Harvard Graphics for Windows	369
T/Maker		
GR5103/5	FaxMania	29
ZSoft		
GR0634	PC Paintbrush IV Plus	119

CAD PRODUCTS

American Small Business Co.		
CA0023/5	Design CAD 3D 3 1	198
CA0203	Design CAD 2D	175
AutoDesk		
CA0173/5	Autosketch 3 0	146
Generic Software		
CA0074	Generic CADD 6 0	285

BUSINESS

Abracadata		
BS6344	Everybody's Planner	49
AddStor		
UT2194	SuperStor 2 0	85
Alpha Software		
BS2164	Alpha FOUR Version 2 0	339
Application Techniques		
UT2444	CaptureEze	45
Approach Software		
BS6194	★Approach for Windows	149
Artworx		
BS5004	Graftek 2 0	129
AutoMap, Inc.		
BS5224	AutoMap	50
Borland International		
BS0774	dBASE V 1 5	489
BS0214	◆Paradox 3 5	519
BS3044	◆Quattro Pro 4 0	319
Campbell Services, Inc.		
BS3584	★OnTime for Windows	75
Central Point Software		
UT2064	Central Point Anti-Virus	85
UT2133/5	★PC Tools 7 1	119
Computer Associates		
BS5543	★dBFast	349
FN0523	★ACCPAC Simply Accounting for Windows	129
Dariana Tech.		
UT1704	★WinSleuth Professional 2 0	105
Datastorm Tech.		
CM0424	PROCOMM PLUS 2 01	72
DataViz		
NT3620	MacLink Plus/PC	139
DCA/Crosstalk Communication		
CM0194	★Crosstalk for Windows	129
Deirina Technology		
BS2604	★PerFORM PRO 3 0	185
FX0154	★WinFax Pro 2 0	75
BS0853/5	PerFORM Pro Designer & Filler 2 1	90
Fifth Generation		
UT0724	Direct Access 5 1	65
UT2184	Fastback Plus 3.0	125.
Fox Software		
BS0705	Foxbase + Dev System 2 10	189
BS4065	FoxPro 2 0	495
Gibson Research		
UT0674	Spinrite II 2 0	65
Helix		
BS3154	NETROOM 2 0	59
Inset Systems		
UT1514	HiJaak 2 1	129
Intuit		
FN0164	Quicken 5 0	43
FN0564	★Quicken for Windows	35
Lotus		
SI0153/5	★◆Lotus 1-2-3 & Ami Pro 2 0 Double-Up Upgrade	155
BS4204	◆Ami Pro 2 0	299
BS5203/5	◆Lotus 1-2-3 3 1 Plus	419
BS4073/5	◆Lotus 1-2-3 Re 2 3	339
BS5253/5	★◆Lotus 1-2-3 for Windows	399
BS3973	Lotus Graph Writer II	335
Microcom		
CM0574	★◆Carbon Copy for Windows	135
CM0084	Carbon Copy Plus 6 0	129
Microsoft		
UP0153/5	DOS 5 0 Upgrade	49
BS3254	★◆Excel for Windows 4 0	309
FN0464	★Microsoft Money for Windows	45
BS4103/5	★Office 2 0 for Windows	485
BS2733/5	★Productivity Pack	39
BS2704	★◆Project for Windows 3 0	445
BS1954	★Windows Developer s Tool Kit	315
WP0043/5	Word 5 5	209
WP0374	★◆Word for Windows 2 0	299
BS5324	★◆Microsoft Works for Windows	129
BS0173/5	Works 2 0	95
Multisoft Corporation		
UT0554	PC-Kwik Power Pak 2 1	75
UT0543/5	Super PC - Kwik 4 1	45
Norton-Lambert		
CM0503/5	★Close-Up 4 0 f/Windows & DOS	119
Okna Corporation		
BS3124	★The DeskTop Set 3 0	79
PC Globe, Inc.		
BS1834	PC Globe 5 0	37
BS1844	PC USA 2 0	29
Peachtree Software		
FN0233/5	Peachtree Complete III 5 0	145
Polaris		
BS2894	★PackRat 4 0	259
Power Up Software		
BS1654	Calendar Creator Plus 4 0	55
Qualitas		
UT0684	386MAX 6	61
Quarterdeck Office System		
BS1043/5	DESQview 386 2 4	129
EX1103/5	QEMM 386 6 0	61
Reference Software		
WP0514	★Grammatik Windows	55
Software Directions		
UT1914	Print Q 5 0	85
Spinnaker Software		
BS1923/5	BetterWorking Eight-In-One	32
BS3604	★PFS Window Works	95
Symantec		
UT2273/5	Norton AntiVirus 2 0	85
UT2183/5	★Norton Desktop for Windows	99
UT2313/5	Norton Util Advanced 6 01	115
UT2153/5	★Norton Backup Windows/DOS	85
CM0173/5	PC Anywhere 4 5 Host and Remote	119
BS4013/5	◆Q&A 4 0	255
BS3723/5	★On Target 1 0	255
Technology Interchange Group		
BS5915	The Hard Disk Survival Kit	169
BS5905	Your PC Inside-Out	169
Teleware		
FN0414	★M Y O B for Windows	135
Timeslips		
BS5953/5	★TimeSheet Professional for Windows	145
BS0133/5	Timeslips III 4 0	189
Tool Technology Publishing		
UT2253	★WinTools	125
Traveling Software		
UT2074	LapLink Pro 4 0	109
Triton		
CM0543/5	CO/Session	99
WordPerfect Corp.		
WP0363/5	◆WordPerfect 5 1	279
WP1653/5	★◆WordPerfect 5 1 for Windows	295
WordStar U.S.A.		
WP1604	★Correct Grammar for Windows	69
XTree Company		
UT1874	XTree Gold 2 5	99

LANGUAGES

Borland International		
LN1654	Borland C++ 3 0 Prof	329
LN0484	★C++ for Windows	319
LN1664	★Object Vision 2 0 for Windows	105
LN0464	Turbo C++ 2nd Edition 1 0	69
LN0463/5	★Turbo C++ for Windows	105
Microsoft		
LN0085	QuickBasic 4 5	65
LN1674	◆Visual Basic	129

Bernoulli PC Powered

Bernoulli PC Powered ... the Data Storage System that provides endless ... growth ... Perfect for storage ... Windows ... desktop publishing applications ... the ... CPU powered drives ... MB of ... performance ... cost effective ... with ... Bernoulli ... reliability ... transportable ... Backup ... restore operation. **Manufacturer: Iomega DR2240**

$739

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Everybody's Planner

Everybody's Planner is an affordable and easy-to-use project manager which contains two complete programs. SCHEDULES creates critical-path-based P.E.R.T charts and project calendars which provide plans up to 9 years long with 1870 tasks and 1000 resources. It features pull-down menus, current/alternate calendars, seven text and two graph (Gantt) reports, automatic or manual rescheduling, and easy editing features. FLOWCHARTS uses 19 rotatable flowchart shapes in 9 sizes, vertical and horizontal labeling, and an Activation feature which uses color to depict flow sequences.
Publisher: Abracadata BS6344

$49

Design Your Own Home: Architecture, Interiors, Landscape

With Architecture, you can draw professional-quality floor plans, side view building plans and structural details in record time, trimming home improvement costs. Architecture automatically calculates all distances, areas, and angles. Interiors is a beautifully simple approach to a more beautiful home. Arrange and rearrange furnishings in seconds. Explore subtle color schemes and variations. Switch from top views to side views. Landscape is easy to use and can help prevent costly mistakes. Position flowers, shrubs, trees, walks, steps, fences, etc. for that look you want. Dozens of sample plans are included with each version. Modify them or create your own.
Publisher: Abracadata *Interiors* EN2704 $49. *Landscape* EN2714 $49.

$43

Architecture EN2694

Design your Own Railroad

Design precision, to-scale (HO, N, O, Z, S, G) layouts using unique track-laying tools. A complete set of drawing tools allows you to add rolling stock, scenery, and structures to your layout. It's better than a model railroad in your basement. **Publisher: Abracadata EN2684**

$35

AUTOMAP

AUTOMAP helps you find the best route for your trip with hundreds of up-to-date color maps, detailed driving instructions and listings of alternate routes. It even prints a map for you. **Publisher: AUTOMAP, Inc. BS5224 $50.**

Bodyworks

Now you can explore the human body's systems, structures, and functions in fascinating interactive detail. Includes a special health section with information on first aid, general fitness, sports injuries, and common illness. **Publisher: Software Marketing ED3034 $49.**

Orbits

Orbits lets you explore the worlds of wonder in outer space. This interactive space simulator and solar system atlas features animation and 3-D graphics. Requires 512K RAM, EGA or VGA color graphics, and supports a mouse.
Publisher: Software Marketing ED3044

$39

NETROOM 2.0

Now the PC magazine Editors' Choice winning memory manager is even better. NETROOM version 2.0 has a fully automated installation program which optimizes your PC's memory configuration. Quantum technology relocates your system's BIOS freeing up an incredible extra 96K worth of high DOS. NETROOM goes even further, creating a Virtual Machine of up to 576K for programs and networks, leaving you with up to 626K free! Only NETROOM provides access to extended or expanded memory above 1Mb and works on 8088/386 PCs, running DOS and Windows. Publisher: Helix. Also available in ***4 user*** **BS5304 $109.** ***10 user*** **BS5314 $185.** and ***NETROOM 2.0 with DOS 5.0 Bundle*** **BS0013/5 $99.**

Single user **BS3154**

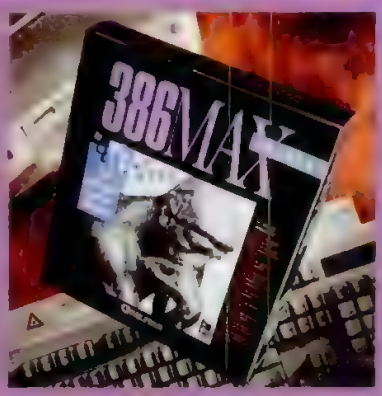
$59

386MAX 6

Winner of 1991 BYTE Award of Merit, PC Magazine's Editors' Choice Award, InfoWorld Buyers Assurance Seal and InfoWorld's Top-Scoring Memory Manager. 386MAX 6 is perfect for both experienced and novice users. The new graphical interface seamlessly integrates memory management with a powerful system analyser. After reliably recovering the most high DOS memory, your system is automatically optimized and configured for the most conventional memory. 386MAX has both ROMsearch and VGAswap and features easy installation and optimization, a Windows-compatible disk cache, and SmartMemory.
Publisher: Qualitas
Also available ***BlueMAX 6*** **UT1673 $79.**

386MAX 6 **UT0684**

$61



☆Presentation Task Force CGM clip art 4.0

Now you can own the clip art PC Magazine recently called "The best CGM clip art package for overall quality and usability." Presentation Task Force 4.0 is the only clip art product to feature over 3,500 high quality, color illustrations in one value packed, comprehensive volume! Use PTF clip art to enhance presentations, newsletters, and spreadsheets created with over 60 leading DOS and Windows applications, including CorelDraw! Designer, Harvard Graphics, Microsoft Publisher, PageMaker, Persuasion, PowerPoint, Quattro Pro, Ventura Publisher, Word for Windows, WordPerfect, and many more! PTF 4.0 contains people, animals, business symbols, medical illustrations, holidays, sports, military, and environment related images. **Publisher: New Vision Technologies, Inc. GR5174**

$134

The UnMouse

The UnMouse does everything a mouse can—only faster, easier, and in less space. To move the cursor, simply slide your finger over the glass surface. To make a selection merely press down. The UnMouse also serves as an extended keyboard. Tap the large red button and you have a Power Keypad with 16 keys instantly available to execute macros (60 in advanced mode). With its one million touch points the UnMouse also performs as a small graphics tablet. **Manufacturer: Microtouch IN0810**

$165

CIRCLE 225 ON READER SERVICE CARD

SUMMARY OF FEATURES

Products listed in alphabetical order

—Editors' Choice
■—Yes ❑—No

	Clip'nSave	Conversion Artist	DoDOT	FullShot	HALO Desktop Imager	ImagePrep	The Juggler
IMAGE PROCESSING (continued)							
Processing functions:							
Crop	❑	❑	■	■	■	❑	■
Rotate	❑	❑	❑	■	■	■	■
Flip and mirror	❑	❑	❑	■	■	■	■
Invert to negative image	❑	❑	■	■	■	■	■
Dither	❑	■	■	■	■	■	■
Brightness and contrast controls	❑	❑	❑	❑	■	■	■
Gamma correction	❑	❑	❑	❑	■	■	■
Edge tracing	❑	❑	❑	❑	■	■	❑
Sharpening	❑	❑	❑	❑	■	■	❑
Softening	❑	❑	❑	❑	■	■	❑
Posterizing	❑	❑	❑	❑	■	❑	■
Resizing	■	❑	❑	■	■	■	■
Resampling	■	❑	❑	❑	❑	❑	■
FILE CONVERSION							
Import/export formats:							
.BMP	■/■	■/■	■/■	■/■	■/■	■/■	■/■
.CLP	❑/❑	❑/❑	■/■	■/■	❑/❑	❑/❑	❑/❑
.CUT	❑/❑	■/❑	❑/❑	❑/❑	■/■	❑/❑	❑/❑
.DIB	■/■	■/■	■/■	■/■	■/■	❑/■	■/■
EPS	❑/■	❑/■	■/■	❑/❑	❑/❑	❑/■	❑/■
.GIF	■/■	■/■	■/■	❑/❑	■/■	■/■	■/■
.IMG	❑/❑	■/■	■/■	❑/❑	■/■	❑/❑	■/■
.LBM	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑
.MSP	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	■/■
.PCX:							
Color	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Compressed	■/■	■/■	■/■	■/■	■/■	❑/❑	■/■
Gray-scale	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Monochrome	■/■	■/■	■/■	■/■	■/■	❑/❑	■/■
.RLE	■/■	❑/❑	■/■	❑/❑	❑/❑	❑/❑	❑/❑
TIFF:							
Color	■/■	■/■	■/■	■/■	■/■	■/■	■/■
Compressed	■/■	■/■	■/■	■/❑	■/■	❑/❑	■/■
Gray-scale	■/■	■/■	■/■	❑/❑	■/■	■/■	■/■
Monochrome	■/■	■/■	■/■	■/■	■/■	■/■	■/■
.TGA	❑/❑	■/■	❑/❑	❑/❑	■/■	■/■	■/■
.WMF	❑/❑	■/❑	❑/❑	❑/❑	❑/❑	■/■	■/■
.WPG	❑/❑	❑/❑	■/■	❑/❑	❑/❑	❑/❑	❑/❑
Macintosh formats:							
.MAC	❑/❑	❑/❑	■/■	❑/❑	❑/❑	❑/❑	■/■
.PICT2	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	■/■
Motorola TIFF	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑	❑/❑
Batch operation:							
Converts groups of files	❑	■	❑	❑	■	❑	❑
Records and runs macros	❑	❑	❑	❑	❑	❑	❑
PRINTING OPTIONS							
Specifies image size	■	■	■	■	■	■	■
Specifies position of image on page	❑	❑	■	■	■	■	■
Specifies number of copies	■	❑	■	■	■	❑	■
Specifies draft resolution	■	■	■	❑	❑	❑	■
Tile	❑	❑	■	■	■	❑	■
TECHNICAL SUPPORT							
Documentation	■	■	■	■	■	■	■
Reference manual	■	■	■	■	❑	■	■
On-line help	■	■	■	■	■	❑	■
Toll-free telephone support	❑	❑	■	■	❑	■	■

Paint Shop Pro	PictureEze	SnapIT!
■	■	■
■	■	□
■	■	■
■	■	■
■	■	■
■	■	□
■	□	□
■	□	□
■	□	□
■	□	□
■	□	□
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□	□	□
□	■	□
■	□	□
□	□	■
□	□	■ (through Control Panel only)
□	□	■ (through Control Panel only)
□	□	□
■	■	■
■	■	■
■	■	□
□	□	□
		ENDS

ImagePrep

When Computer Presentations decided earlier this year to reduce the price of *ImagePrep* from $295 to $149 the company was no doubt motivated by a flood of competing products. What could have been a buyers' bonanza, however, was muted by the fact that only a few substantial changes have been made to this product since it won *PC Magazine*'s Editors' Choice in this category one year ago—namely the addition of several filter effects and a merge-images utility. In the interim, newcomers to the category have been redefining the state of the art. This is not to say that *ImagePrep* is anything short of a good all-around utility: It remains unmatched in the area of color manipulation.

Its screen capture, though Spartan, is powerful enough for most users. You can designate the screen, a window, or a client window as the capture area, or define a rectangular area using the custom tool, which shows but does not capture the pixel coordinates as you size the area. You can save the resulting images to disk or send them to the Clipboard; there is no option to send the file directly to the printer. You can invert black and white in an image to improve printing. In addition, you can choose any key or multiple key combination as the hotkey.

ImagePrep's screen capture, though Spartan, is powerful enough for most users.

The program supports 24-bit color and 256 gray levels, as well as a variety of processing filters, but it has trouble reading some .PCX files; the program does not support .PCX files with fewer than four bits per pixel (16 colors), for instance. Additionally, *ImagePrep* still can't convert files upward to larger palette formats; for instance, from 16-bit TIFF to 24-bit TIFF or Targa. Another surprise is the program's lack of batch conversions and image-effects macros—major omissions in a program that touts its high-end qualities. You can display a full-screen image (without menus or window handles), but there is no way to set up a series of screens for a presentation. You wouldn't want to do it anyway, since screen redraws are painfully slow. The program does support interruptable redraws, however, giving you access to the pull-down menus during the slow redraw process.

NO MULTIPLE IMAGES

Although *ImagePrep* still does not support multiple images, which would utilize the MDI (Multiple Document Interface), it can merge two images saved in the uncompressed proprietary .CPI format. Controls for positioning the two images, however, are less than intuitive, and without a preview of the merged images, correct positioning requires some trial and error.

The program includes an array of im-

***ImagePrep*, Version 4.0**
Computer Presentations Inc., 1117 Cypress St., Cincinnati, OH 45206; 513-281-3222.
List Price: $149.
Requirements: 286-based PC or better, 1MB RAM, 20MB hard disk space, EGA graphics adapter or better, DOS 3.3 or later, Microsoft Windows 3.0 or later Mouse recommended.
In Short: While no longer the trendsetter it once was, *ImagePrep*, Version 4.0, is still a good, all-around utility for image capture and manipulation. Its image-capture capabilities are powerful, and its color manipulation is unbeatable.

CIRCLE 482 ON READER SERVICE CARD

SUITABILITY TO TASK

ImagePrep				
Color manipulation	●	●	●	●
File conversion	●	●	○	○
Image processing	●	●	●	●
Printing	●	○	○	○
Screen capture	●	●	○	○

age-processing features, but lacks a crop/mat feature, which severely limits its usefulness as a desktop publishing/presentation tool. Processing, including the application of effects filters such as edge tracing, sharpening, and softening, must be applied to images globally.

Running the program under Microsoft Windows 3.1's final beta version produced one distinct problem that CPI confirmed will require a rewrite: When the menu command to display a full-screen image is selected, the screen turns black and locks up, and even Windows 3.1's local reboot could not recover. That problem notwithstanding, *ImagePrep* remains a solid if underpowered graphics utility.

The Juggler

The Juggler, Version 1.0, from Jewell Technologies, is a tough program to figure out. It promises lots of flash, but fizzles when it is time to deliver. This $149.95 package offers some interesting special effects, but it just can't manage to produce the basics.

The program starts out sensibly enough. The Setup box lets you specify the capture area for variable size, entire screen, window or client area, and send images to *The Juggler* window, a printer, or save them in one of 13 formats. You can't choose these destinations in combination, however, and the capture function's default setting is disabled.

The program has problems with its captures. On our tests, *The Juggler* lopped off the right side of the screen, although the colors were accurate and the ensuing gray-scale conversion was satisfactory. It had similar problems with capturing a *Lotus 1-2-3* worksheet in a DOS window: Here it managed to capture the worksheet in a readable form, though it lacked the title and scroll bars. An attempt to convert this color image to 16 gray scales and then invert it produced black, white, and one shade of gray.

The quality of the captures isn't the only problem. Finding an image this program saves to disk is like playing hide-and-seek. *The Juggler* hides the image in some subdirectory and you seek it out. It gets worse. The result of pointing and clicking in the File Open box to change directories is so quirky that you're better off typing in the drive letter and the subdirectory. When you finally find the file you need, be prepared for a cryptic message like "Selected file is not a valid .PCX file" followed by an equally cryptic "!default.pcx is not a Legitimate DIB file!" Funny, these formats were valid when *The Juggler* stored them. And if you try to open a file type that Juggler can't read, like any kind of 24-bit image, the program crashes rather than gives you an error message.

SUITABILITY TO TASK

The Juggler				
Color manipulation	●	●	○	○
File conversion	●	●	●	○
Image processing	●	●	●	○
Printing	●	○	○	○
Screen capture	●	●	○	○

FANCY FEATURES

Though *The Juggler* has problems with the basics, it manages some fancy tasks, such as creating collages. Instead of work-

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***The Juggler*, Version 1.0**
Jewell Technologies Inc., 130 Nickerson St., #105, Seattle, WA 98109; 800-284-2574, 206-285-6860.
List Price: $149.95.
Requires: 286-based PC or better, 2MB RAM (4MB RAM recommended), EGA display or better, Microsoft Windows 3.0 or later, mouse.
In Short: *The Juggler*, Version 1.0, promises some fancy tricks, but it fails to deliver the basics. With this package, you'll wait forever for screen redraws and be kicked out to DOS if you ask the program to open an unsupported file type or to try to print anything but a .BMP file. It's hard to recommend a program this unstable

CIRCLE 483 ON READER SERVICE CARD

ing with only one image at a time or placing multiple images in separate windows, the program lets you merge files on the same drawing board. It also gives you some control over the degree of transparency of each image overlay. This part of the program is quite advanced compared with some of the other programs, but it's not something a casual user is likely to manipulate well without studying the manual and doing a lot of tweaking.

Instead of working with one image at a time or placing multiple images in separate windows, *The Juggler* lets you merge files on the same drawing board.

The problem with these features is that they cause the screen to redraw, and redraws are painfully slow, even on a 486 machine. To make matters worse, you can't access any of the menus during the redraw process. In addition, the program lacks batch-conversion facilities. On a more serious level, *The Juggler* is prone to locking up (requiring you to reboot your computer) and kicking you out to the Windows Program Manager.

Trying to print is the most frustrating part of all. On our tests, the program succeeded in printing only .BMP files. Attempts to print .GIF files produced blank pages, while TIFF files resulted in UAEs (Unrecoverable Application Errors). Technical support didn't seem to have a clue about the problem.

It is hard to recommend a program that is as unstable as this one, no matter how many flashy tricks it can perform. Perhaps *The Juggler* needs to concentrate on the simple tasks before it tries to juggle flaming torches.

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Paint Shop Pro

Paint Shop Pro, Version 1.0, probably won't meet all of your image-capture and manipulation needs, but it's a good place to start. This rather powerful and inexpensive $49 utility from JASC is unique among the products reviewed here: It is distributed as shareware and can be downloaded from either PC MagNet or the PSL libraries on ZiffNet. If you're sitting on the fence, unsure of whether you need an expensive utility, try this one.

For all of its ability and breadth of features, *Paint Shop Pro* is decidedly lacking in a few areas. It can capture only full screens and user-defined rectangles. Although it can hide or iconize itself during captures, capturing is executed by menu selection rather than by hotkeys, and there are no automatic controls for saving the capture to disk as there are in other programs. Its printing functions are also minimalist, but output proves acceptable.

What is amazing, though, is the breadth of function that *Paint Shop Pro* delivers for the buck. Only *HALO Desktop Imager*—at more than double *Paint Shop*'s price—gives you more control over image enhancement. In this program, you must apply effects to an entire image rather than to a user-defined area as in *HALO*. You can choose from a variety of image-enhancement filters, including edge tracing, blurring, and embossing. Moreover, you can use the filter editor to alter the provided filter matrixes to create your own effects.

Color reduction is a snap with *Paint Shop Pro*. You can reduce or increase color palettes in all the usual ways, including dithering, with simple menu selections. You can process images using the standard Windows palette or by creating an optimized palette that picks the best 16

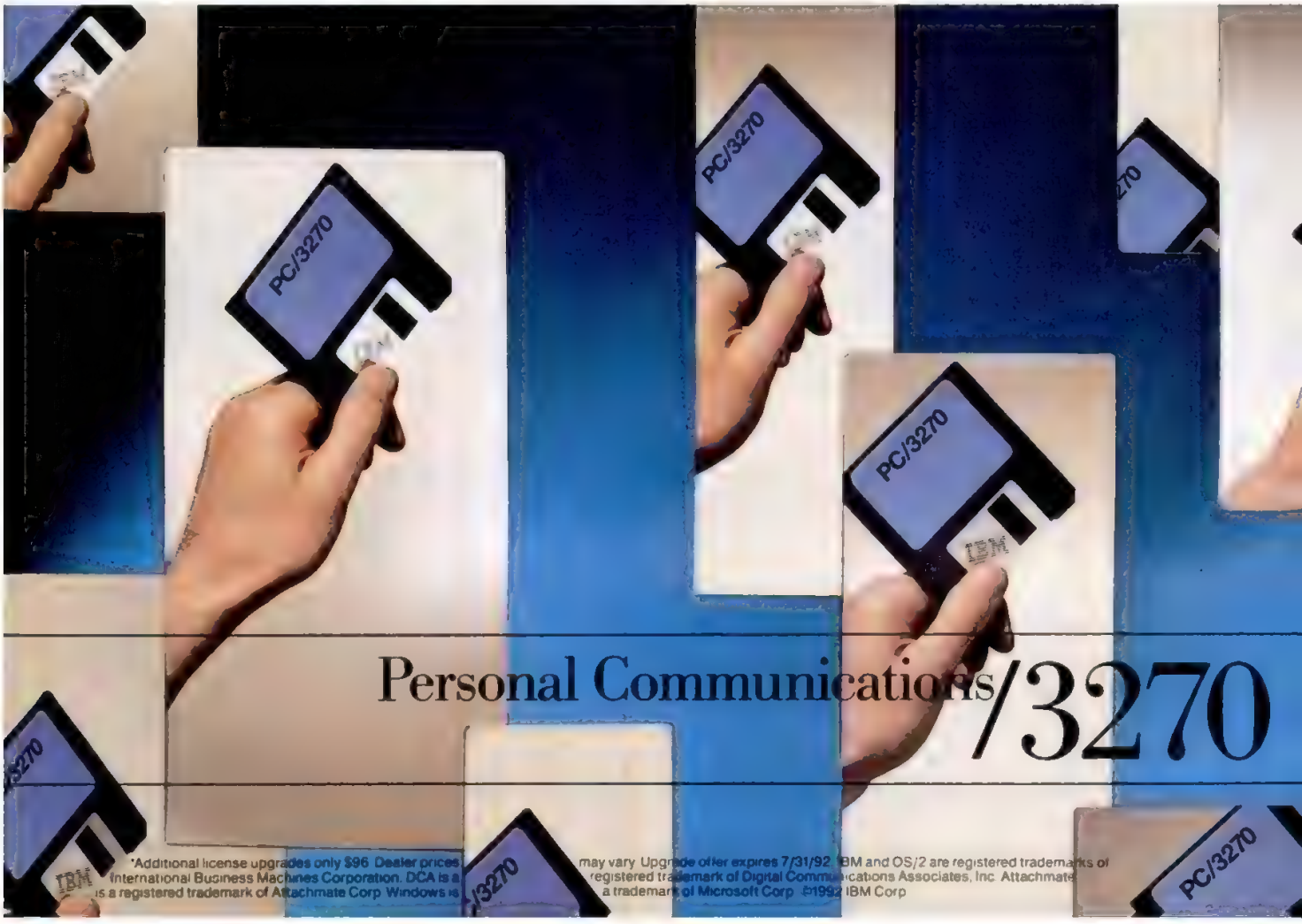
SUITABILITY TO TASK

Paint Shop Pro				
Color manipulation	●	●	●	○
File conversion	●	●	○	○
Image processing	●	●	●	●
Printing	●	○	○	○
Screen capture	●	○	○	○

FACT FILE

***Paint Shop Pro,* Version 1.0**
JASC Inc., 17743 Evener Way, Eden Prairie, MN 55346; 612-934-7117.
(Available on PC MagNet in the Microsoft Windows Utilities Section of the Util Forum. Filename: PSP.ZIP.)
List Price: $49.
Requires: 286-based PC or better, 2MB RAM (4MB recommended), Microsoft Windows 3.0 or later (in Standard or Enhanced mode), mouse or trackball.
In Short: ***Paint Shop Pro,* Version 1.0, may not have all of the features you need for image capture and manipulation, but it has enough to get you started. And at a price that's less than half of most of the others, you may not want to look elsewhere.**

CIRCLE 484 ON READER SERVICE CARD



or 256 colors for your image. Although several other programs can create .MAC files, only this one makes the process easy. A simple menu command resizes your image to Macintosh specs, optionally inverts the colors, dithers the image to black and white, and frames the area outside the image so you can display it on a Macintosh.

A RESIZING WHIZ

Paint Shop Pro excels at resizing images. You can resize images to match any standard screen or custom size. Additionally, you can resample 24-bit and gray-scale images to remove the jaggies inherent in enlarging small images. The effects are startling, although the controls used to maintain aspect ratio are a bit confusing: The control button doesn't override the user-defined image size as it should.

The quality of capture and color reduction is equal to any of the more expensive utilities. Gray scales appear well distributed, and dithered images look reasonably attractive when displayed on 16-color systems.

The program imports and exports a fairly large set of file formats. You can save files in several compressed formats including LZW, Packbits, and Huffman, as well as *Paint Shop Pro*'s proprietary .JAS format, which is based on the JPEG spec.

You have little to lose by checking out *Paint Shop Pro*. It will serve as a stepping stone to another utility that more closely matches your needs, or just maybe, it will be the pot of gold at the end of your quest for the best graphics utility.

PictureEze

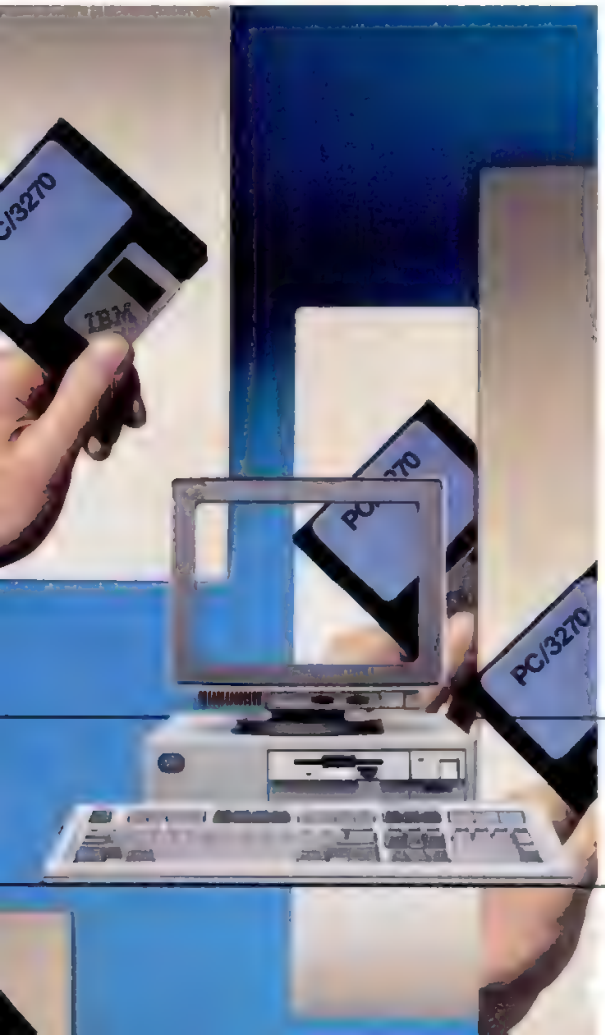
If your idea of the perfect graphics conversion utility is one that lets you click a button then sit back, Application Techniques' $149 *PictureEze*, Version 2.0, is full of promise. This utility has no inherent screen-capture capabilities (it's bundled with *CaptureEze* for that purpose), but it can automate the process of adding a series of effects to your captured image.

To capture a screen, you must launch the *CaptureEze* module, but the Install program makes this easy by offering an option to load *CaptureEze* automatically each time you start Microsoft Windows. The *CaptureEze* Setup box provides options for auto-incrementing filenames; capturing the whole screen, active window, or client area; and reassigning two hotkeys. You can either select file types by application or by file extensions; some 100 applications are listed. However, you must load any images captured in *CaptureEze* into *PictureEze* from disk.

The pièce de résistance is *PictureEze*'s macro-like recorder, which can log up to 32 sequential effects into what it calls a *Recipe*. Recipes are named, saved, and loaded separately from image files. So if you have a penchant for cropping, flipping, inverting, and gray-scaling, this pro-

SUITABILITY TO TASK

PictureEze	
Color manipulation	●●●○
File conversion	●●●●
Image processing	●●○○
Printing	N/A
Screen capture	●●○○



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***PictureEze*, Version 2.0**
Application Techniques Inc., 10 Lomar Park Dr., Pepperell, MA 01463; 800-433-5201, 508-433-5201
List Price: $149.
Requires: 286-based PC or better, 640K RAM (2MB recommended), EGA display or better, Microsoft Windows 3.0 or later. Mouse recommended.
In Short: *PictureEze*, Version 2.0, is headed in the right direction with its Recipes for automating image processing, but sluggish screen redraws, inexact captures, and the inability to print show that the program is in need of an overhaul.

CIRCLE 485 ON READER SERVICE CARD

gram is ready to take notes and execute the same sequence on another image.

Once you launch a Recipe, the program really cooks. It puts successive percentage sliders on the screen, announcing crop in progress, color reduction in progress, rotation in progress, and so on until it prompts you to save the file. The image isn't displayed until all of the processing is finished and you have passed the File Save dialog box. Clearly, this is not the sort of power you want to unleash on an image unless you're sure about what you want—and have a copy of the original safely stored on-disk.

PictureEze's macro-like recorder can log up to 32 sequential effects into what it calls a _Recipe_.

Yet, in some ways, Recipes are half-baked. No canned Recipes are provided and there are no facilities for editing one of your own. In addition, although Recipes are automated, *PictureEze* provides no batch file capability.

SLUGGISH PERFORMANCE

Outside of Recipes, the program waives its performance edge. Screen redraws are sluggish. For instance, it took 20 seconds for an image to redraw after displaying something as simple as file information—a separate status screen listing image attributes. You can, however, access pull-down menus to issue commands while the screen is redrawing.

The Select Crop Area command is even more frustrating. The program first writes a copy of the file to the hard disk, which, depending on the image, can take half a minute. But instead of turning the screen pointer into a Windows-conventional hourglass, the program displays a deceptively ready-to-use four-headed arrow. You try to point and

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click, but nothing happens. Finally, a faint outline appears at the corners of the screen, and the icon turns into a two-headed arrow that works.

On our tests, the .PCX capture was a close but not perfect match to the original. Slight moire patterns showed up on five colors that were solid in the original. This difference was most discernible on the grayish buttons and borders. In a matched gray-scale reduction (4 bits, 16 shades), on-screen results were surprisingly tinged with purple and brown hues—a display problem in modes with few colors rather than an image problem.

It would have been instructive to see how the results printed, but alas, neither *CaptureEze* nor *PictureEze* can print. *CaptureEze* captured the *Lotus 1-2-3* worksheet in a DOS window, which we saved to a color TIFF format. Loaded into *PictureEze,* the image colors matched, although the white characters were slightly dull. Our gray-scale reduction resulted in two levels of gray, a jet-black background, and off-white text. The Invert Image Colors command produced crisply readable characters on a white background, but the title bar appeared a tad tan.

PictureEze is headed in the right direction with its Recipes routine and wide array of supported formats. What it needs to do next is improve the rest of its performance and find a way to print.

SnapIT!

Programs don't get much leaner than *SnapIT!,* Version 1.2, a $69.95 Microsoft Windows utility, from Window Painters, that grabs any rectangular area of the screen, prints it, and saves it. Basically, that's all you get with this program.

There is not a File Open command, so don't try to view your captured images. And don't bother looking for on-line help, either; there isn't any. Then again, you probably won't need it.

Unlike the other programs reviewed here, you don't install *SnapIT!* from the Windows Program Manager. You do it from DOS, and then the program loads automatically when you start Windows. A camera icon captioned *SnapIT!* squats in the bottom-left-hand corner of the screen outside of the Program Manager. Clicking on it produces a pop-up menu that lets you set defaults or start the *SnapIT!* trace (screen capture) function. The program saves files incrementally to a short list of file types. The *SnapIT!* Preferences box enables you to reset the default hotkey from F2 to any other function key (or Ctrl-function key), including F1.

Capturing the entire screen requires a little more dexterity here than in other programs, since you must hold down the mouse button and stretch a marquee across the screen after you press the hotkey. By pressing the Scroll Lock key, you can capture only the active window.

You have two choices for printing: placing the image in the upper-left-hand corner of the page or centering it. Just re-

SUITABILITY TO TASK

SnapIT!				
Color manipulation	●	●	○	○
File conversion	N/A			
Image processing	●	●	○	○
Printing	●	○	○	○
Screen capture	●	●	○	○

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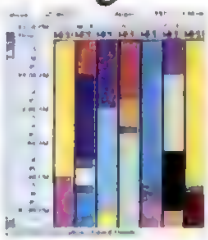

conference room, search for a free time block, send a memo to a hundred people, schedule a meeting for 25 differ-

***SnapIT!*, Version 1.2**
Window Painters Ltd., 7275 Bush Lake Rd., Minneapolis, MN 55439; 612-897-1305.
List Price: $69.95.
Requires: 286-based PC or better, 1MB RAM (2MB recommended), EGA display or better, Microsoft Windows 3.0 or later, mouse.
In Short: A lean, mean program in its current incarnation, *SnapIT!*, Version 1.2, does a good job of capturing screens and printing them, but it does little else. Look for *SnapPRO!*, Version 2.01 (the next version of the program, which should be available by the time you read this), to add greater file-format support and some nifty special effects.

CIRCLE 486 ON READER SERVICE CARD

member to make that decision in the Preference box before snapping the image. Once the image is in the *SnapIT!* Image Control window, the choice is even less involved: You can print the image or not print it. Upon capture, though, you do have a surprising number of on-the-fly options. Besides choosing the file format, you can reduce the number of colors, convert the image to gray scale, dither it, invert it, flip it horizontally or vertically, or copy it to the Windows Clipboard. A Preview button lets you see the results of these options at actual size almost instantly.

HIGH IMAGE QUALITY

Our captures (as seen in the *SnapIT!* preview window) yielded colors and textures indistinguishable from the original. The gray-scale conversion accurately maintained solids and textures in most cases, while presenting a sufficient number of gray shades to offer contrast. When capturing a DOS screen, you have to exercise care to crop the window accurately, since there is no way to set a preference to capture an active window. Still, the resulting image is identical to the original. Clicking on the gray scale and inverse options and then pressing the preview button promptly produced a crisp black/gray-on-white worksheet. The printout wasn't quite as sharp, but the process was fast.

SnapIT!'s lean and mean days may be numbered. A spokesperson for Window Painters says the company will replace the product with *SnapPRO!* (also $69.95) this spring. The new version will no longer be limited to capturing; it will read in all of the existing file types that *SnapIT!* saves, plus Targa, .GIF, and EPS formats. It will also feature expanded capabilities in all of its functions and an image-builder that lets you combine bitmaps, vector drawings, and clip art in a collage.

In its current incarnation, *SnapIT!* isn't meant for heavy-duty use. Its limited number of file-save formats, lack of a batch converter, and inability to load a file from disk are shortcomings that are nonetheless offset by lightning-quick performance and the bare minimum of effects to get the job done. If your needs are simple, *SnapIT!* may well be the program for you. ■

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—Infoworld, Sept. 16, 1991

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SOFTWARE SATISFACTION AND SUPPORT

PHOTOGRAPHY: THOM O'CONNOR

It looks as if free technical support and a solid market image add up to positive user response in our first annual survey on software satisfaction and support.

by Robin Raskin

During the first decade of personal computing, the emphasis was on luring first-time users to install promising new software packages. We were being collectively "outfitted"; software vendors were the tailors. Now that they've got us, software vendors have a decidedly different mission: keeping us. And that, over the long haul, means keeping us satisfied.

With a critical mass of available products, software becomes very much like other retail goods. Name-brand identification and user satisfaction are vital to a company's success. Software vendors are looking for lifelong customers, not one-time buyers.

In our previous issue ("Service and Reliability 1992: How Reliable Is Your PC Vendor?", May 26, 1992), we reported how satisfied you are with the service and support you receive for your hardware dollars. This year, for the first time, we've also asked you about your software preferences. Instead of service and reliability, we concentrated on overall product satisfaction and satisfaction with vendors' technical support. The results of this first *PC Magazine* software survey are presented here.

THE SURVEY

In November 1991, *PC Magazine* distributed a four-page questionnaire to a random sample of 17,000 *PC Magazine* readers. The survey was closed for tabulation purposes on January 15, 1992. Our findings are based on 8,592 answered questionnaires (this represents a 51 percent response rate).

The software section of the questionnaire looked at four categories of software: word processing, spreadsheets, databases, and presentation graphics. Respondents were asked to identify from a list of programs the packages they have used over the past two years. Next, they were asked to rate their overall satisfaction and their satisfaction with the technical support for each product used. Rating was done on a scale of 1 to 10, with 1 representing "not at all satisfied" and 10 representing "very satisfied."

OVERALL FINDINGS

Overall, we are glad to report that in both technical support and overall satisfaction people seem fairly satisfied with their product choices. We joked that the software picture appears to be a sort of Garrison Keillor world, where all the packages scored "above average" in both support and satisfaction, because, with few exceptions, each package garnered a rating of 7 out of 10 or better.

The exceptions are mostly products with one foot out the door—products that either haven't had a major revision in a while, such as *SuperCalc*, or are only marginally supported by their vendors but not actively marketed. Products like *Applause, DisplayWrite, MultiMate,* and *Multiplan* all had scores that fell significantly below the average. These products have been plagued by turmoil within their companies and are, for the most part, on their way toward obsolescence or even oblivion.

THE STATISTICS BEHIND THE STORY

by Jamie LeVine

We asked respondents to do two things: to rate their overall satisfaction with each software package they have used in the past two years and specifically to rate their satisfaction with technical support.

These are two key measures for software, which we rated on a scale from 1 to 10 (highest score). An average (mean) score was calculated for each software package based on the ratings of all respondents who have used the product in the past two years. An overall average was then calculated for each category by adding together all of the mean ratings for different software products and dividing by the number of different products (producing a score where each software package contributes equally, rather than being weighted by market share). This gave us information about each individual software product as well as a value representing the performance of the average package in the given category for each measure (overall customer satisfaction and satisfaction with technical support).

While examining the wealth of data available, we focused only on those differences that were statistically significant at the 95 percent confidence level. This means that if we conducted the exact same study 100 times, the differences presented in this report would be found at least 95 times. Therefore, you can be quite confident that these differences are not due to chance or random error. When a software package is reported to be significantly above or below average on a specific measure, this means that the difference between that package's mean and the overall average for the category is statistically significant at the 95 percent level.

While two packages' scores may fall near each other when ordered by ranking, they may or may not have performed significantly differently from each other based on statistical testing. Any direct comparisons presented between specific software packages have also been tested for statistical significance at the 95 percent level. ■

WORDPERFECT ENVY

One company in particular appears to be handling support the right way: WordPerfect Corp. While the success of WordPerfect's word processor in terms of overall satisfaction does not appear to carry over to the company's other products, success in term of satisfaction with support clearly does. *WordPerfect,* in both DOS and Windows versions, returned some of the highest support and satisfaction ratings in the entire survey (and *WordPerfect for Windows* had only been available on the market for three months when the survey was conducted). Following on its heels, *PlanPerfect* scored high in satisfaction with support, even though it received only an average score in overall satisfaction. *DrawPerfect* also shared the lead in support even though it, too, fell in the average range in the overall satisfaction category.

It seems that WordPerfect Corp.'s unlimited toll-free support has clearly garnered a place in our readers' hearts. By contrast, though Microsoft offers unlimited support, the cost of each call comes out of your pocket. Perhaps it is this "pay as you wait" policy that has Microsoft's tech support rating trailing WordPerfect's in every instance.

COAXING THE INSTALLED BASE ALONG

There's an old industry joke that asks, "How could the Almighty create the entire world in only six days?" The answer? "He had no installed base, of course." The installed user base complicates forward progress. Customers now expect products to be revamped almost annually. But while users beg for the new features and interfaces, they also demand backward compatibility, both for file formats and for their knowledge base. They will not readily abandon their familiar keystrokes, regardless of promised productivity gains.

Lotus 1-2-3 for Windows, Microsoft Word for Windows, WordPerfect for Windows—these represent vendors' latest efforts to move their huge installed

THE SEARCH IS OVER...

As our story continues, we find Dakota Smith, dashing young scientist, and Lexa Kirk, independent journalist, nearing their destination. Both are searching for the secret source of the perfect portable PCs.

Cow!

Are From Gateway 2000!

Dakota and Lexa — Gateway 2000 employees Phil and Mary — were photographed in Beautiful Rushmore Cave near Keystone in the Black Hills of South Dakota.

"Now it's our mission to tell the world about our discovery!"

Dakota pauses. In all the excitement, he has forgotten that Lexa's dream remains unfulfilled.

"I'm sorry, Lexa," Dakota tries to comfort her. "I know you were hoping to find something different — more like a cross between a notebook and a palmtop."

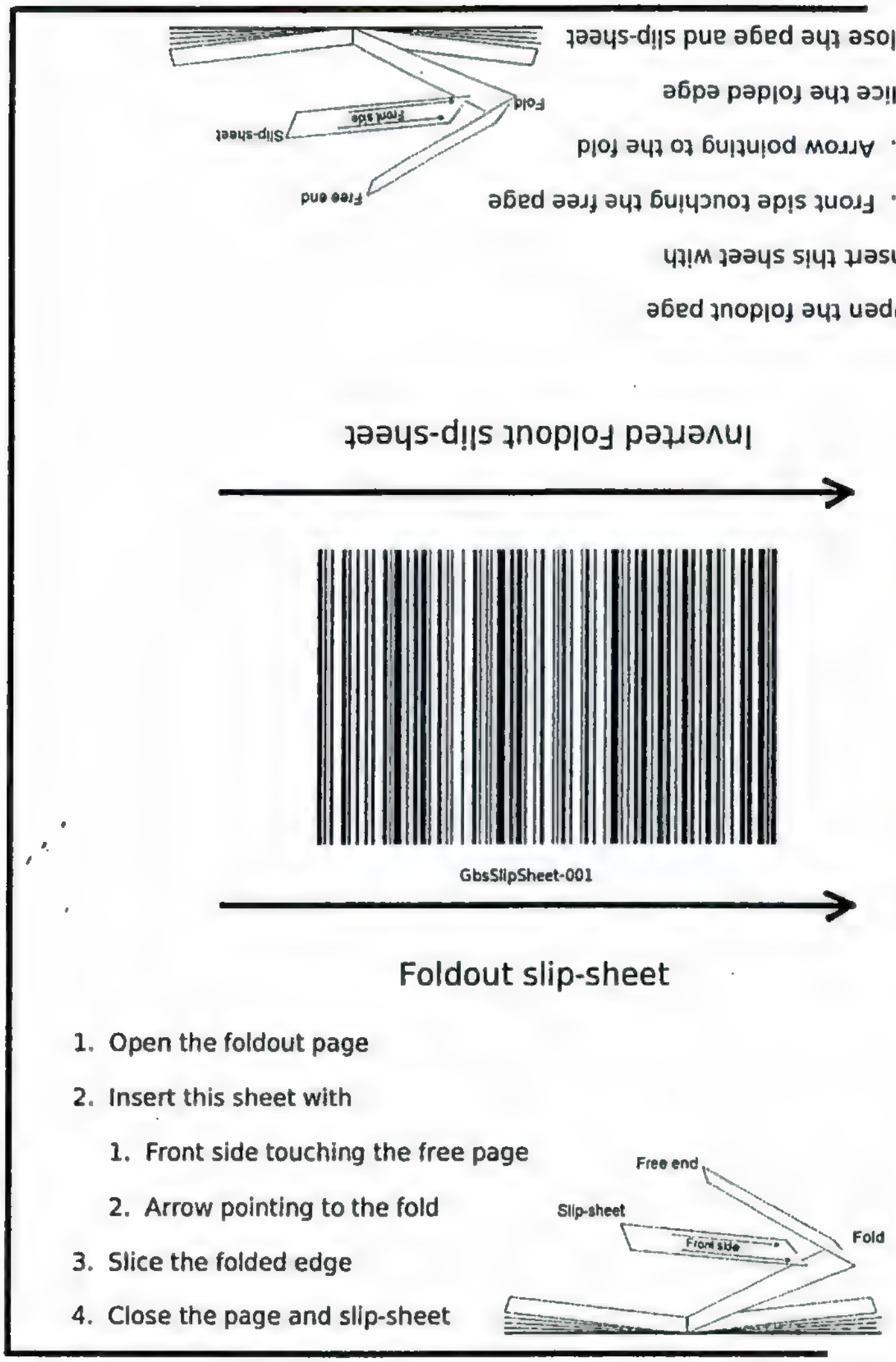
"You're right. These are excellent machines, but they're not quite what I was hoping for," she murmurs.

"But wait!" Dakota shouts, his voice echoing through the cave. "There's another map loaded on my Nomad. Yes, more directions. And the arrow is pointing to something called the HandBook. Do you suppose…?" he wonders.

Dakota and Lexa hurry out of the cave. What they thought was their journey's end has turned out to be just the beginning.

TO BE CONTINUED...

GATEWAY2000


Inverted Foldout slip-sheet
GbsSlipSheet-001
Open the foldout page
Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
Slice the folded edge
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Free end
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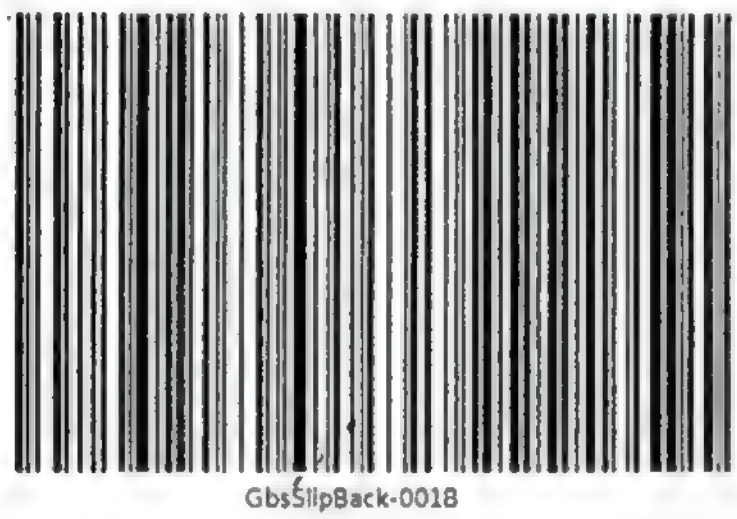

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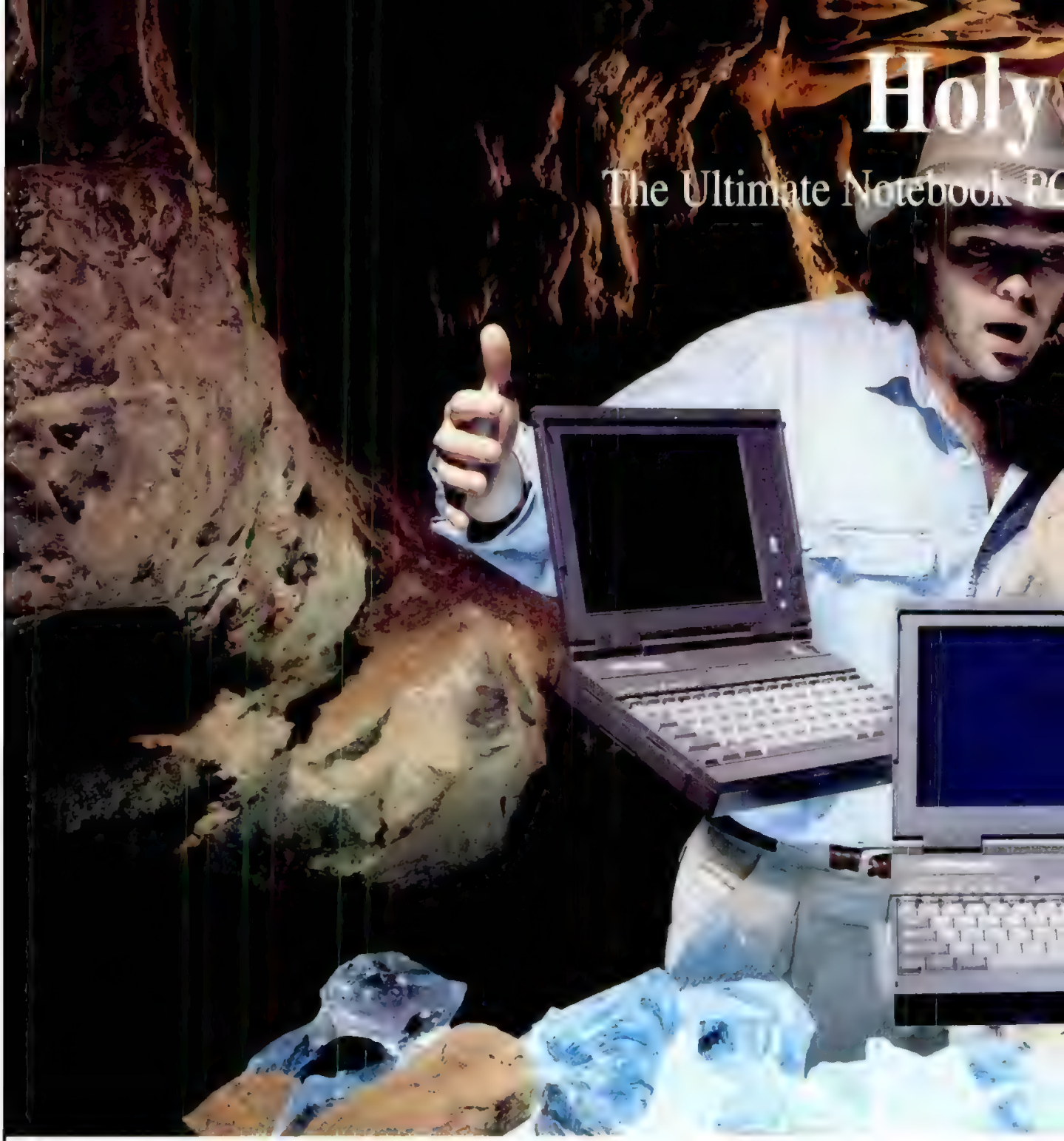

Deep inside a mysterious cave, Dakota and Lexa discover three notebooks called the Nomad Series.

NOMAD They're Dakota's dream come true — notebooks designed for serious computing on the road, all with supernatural battery life, great screens and keyboards, in a compact, lightweight model.

Dakota can't help wondering how these astonishing little machines got here. "They must have been placed in the cave by some ancient civilization advanced beyond our time, or perhaps by beings from another galaxy," he surmises. Lexa, always probing for the truth, points out that the notebooks are clearly marked with the Gateway 2000 logo. Dakota is not satisfied. "Why would Gateway 2000 keep these wonderful notebooks hidden from the world?" he wonders.

"It must be a conspiracy!" Lexa exclaims. "An evil competitor must be behind this! The people at Gateway must have sent us the clues to discover their treasures so we could tell the world!"

"I think you're on to something, Lexa," Dakota agrees.

The Explorers' Notes

PC Magazine says, "Desktop PCs are faster (than notebooks)..." That was before we found the Nomads!

The **Nomad** notebooks we discovered are highly unusual. Our theory is they were designed to let you take desktop computer performance anywhere you go in a small, lightweight notebook. These systems are every bit as powerful as their desktop counterparts. And with patented power management features, the Nomads also have some hard-to-beat battery life benchmarks. We got almost seven hours of operation from a single battery on the 25MHz 486DX system. The Nomad power management system includes a 5.7 amp/hour battery and patented power-saving BIOS and software features.

The backlit, 10-inch VGA Nomad screens are bright and crisp. Resolution is 640 x 480, 64 gray scale, on the LCD. With 1MB video RAM, you can also display 1024 x 768 resolution on a monitor simultaneously.

There's another Nomad characteristic that sets these notebooks apart from most others. They're made in the U.S.A.!

NOMAD

- Weight 5.8 Lbs. (Nomad & Battery)
- Dimensions 8.5" x 11" x 1.8"
- 7-Hr.* NiCad 5.7Ah Battery
- 14.4-Oz. Battery Charger, 6.12" x 2.25" x 1.5"
- Traveling Weight 6.7 Lbs. (Nomad, Battery & Charger)
- Backlit 10" VGA Screen, 640 x 480 Resolution, 64 Gray Scale
- Simultaneous Video with 1MB
- 1.44MB 3.5" Diskette Drive
- 1 Parallel/1 Serial Port
- External Video & Expansion Bus Ports (Ports are Full Size)
- 79-Key Keyboard, 101-Key Emulation, Inverted T Cursor Pad
- Pointing Device
- MS DOS® 5.0 & Windows™ 3.1

Nomad Options: 2,400 bps and 9,600 bps modems, portable printer, numeric keypad, expansion station, Token Ring or Ethernet interfaces, SCSI interface, memory upgrades, executive carrying case, extra batteries

NOMAD 325SXL

- 25MHz, 386SXL Processor
- 2MB RAM
- 80MB Hard Drive

$1995

NOMAD 420SXL

- 20MHz, Intel® 486SX Processor
- 4MB RAM
- 80MB Hard Drive

$2795

NOMAD 425DXL

- 25MHz, Intel 486DX Processor
- 4MB RAM
- 120MB Hard Drive

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bases along the road to progress. Judging from our survey, we find that the support and satisfaction ratings for DOS and Windows versions of a product from the same vendor appear similar. In other words, *Word for Windows* users are about as satisfied with the support they receive as DOS-based *Word* users. Product allegiance seems to apply.

MARKET SHARE ISN'T EVERYTHING

In the case of our database software results, it's clear that market share does not directly correlate with user satisfaction. *dBASE*, clearly the market leader in this category, did not fare especially well in the survey. Again, Ashton-Tate's demise and the uncertain future the product faced as it fell into Borland's hands appear to have influenced users' perceptions. Borland's *Paradox*, on the other hand, is among the leaders in terms of overall satisfaction. Perhaps *dBASE* will gain the confidence of its installed base as Borland continues to show strong support.

Lotus 1-2-3, still strong in market share, is another example of a leading product that scored only average when users rated overall satisfaction. Borland's *Quattro Pro* took the lead in overall satisfaction, and as mentioned, *PlanPerfect* had the highest rating for technical support.

If we could venture a guess as to the results of next year's survey, we'd bet that Windows applications will make a stronger showing in overall satisfaction and in the number of users as reflected by our sample sizes. When our survey was conducted, *WordPerfect for Windows* had just been introduced; *Lotus 1-2-3 for Windows* had been subject to a slipstream release to remedy bugs; *Ami Pro* and *Word for Windows* were virtual newborns; *Freelance Graphics for Windows*, the Editors' Choice in our March 17, 1992, issue, had not yet shipped. Borland's *Paradox* and *Quattro* products were waiting on much-needed Windows-based upgrades that may affect next year's reader poll. The Windows momentum continues.

SATISFACTION AS A STRATEGIC WEAPON

For the software vendor, customer satisfaction has become an important strategic and competitive weapon. Last year's major product releases had finely honed campaigns that stressed ease of use.

Microsoft, WordPerfect, Borland, Lotus, and other vendors have made usability testing a central part of their product development cycles. Usability is based on the notion that a user should be able to master an application without having any specialized knowledge. It's also heavily rooted in the belief that a typical user uses 20 percent of the features 80 percent of the time. The trick for vendors is to make the use of that 20 percent an extremely satisfying experience.

Usability studies are extensive and thorough. Users are videotaped from the moment they receive the shrink-wrapped software. Sometimes a user's every key or mouse entry is recorded, so that difficult command combinations can be rooted out and simplified. The way the user works with a document or on-line help is also scrutinized. Efforts are made to determine how to create features that reflect "real work." *Word for Windows*' mail-merge and *Microsoft Excel* 3.0's AUTOSUM command on the toolbar are two good examples of how usability studies translate into features at a company like Microsoft.

OUR CONTRIBUTORS

Robin Raskin is an executive editor of *PC Magazine*.
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Brad Grimes is the editorial researcher for the *PC Magazine* software team.
Rick Ayre is the PC Labs project leader in charge of software testing.
Jamie LeVine is the senior research manager of *PC Magazine*.

SOFTWARE VENDORS' SUPPORT POLICIES: WHAT THE TABLE SAYS (AND DOESN'T SAY)

by Brad Grimes and Ted Stevenson

For end users deciding which software to purchase, vendors' support policies are a very important consideration. This chart is designed to provide a detailed (though not necessarily complete) picture of those policies.

There are several general points we'd like to emphasize at the outset—some clarifications and considerations you should keep in mind as you examine the chart.

First of all, don't confuse toll-free technical support with free support. A number of vendors offer toll-free telephone support as part of various extended support programs for which they charge often substantial periodic fees. Lotus, for example, charges $129 per year for toll-free *1-2-3* support after the first 90 days of software ownership. Other vendors' extended programs can run as high as $600 per year. Toll-free simply means that the caller doesn't have to pay for the cost of the phone call

Second, don't automatically read a "no" in the line "extended support plans available" as a negative. In the cases of companies that provide free unlimited support for their products, extended plans are normally unnecessary.

Third, while we have concentrated on support policies geared toward individuals, many vendors offer special support programs to corporate customers who purchase multiple copies of software. These can include such features as dedicated support lines, faster response rates, free maintenance releases, beta site enrollment, and admission to developers' conferences.

Further, there are several support alternatives not involving person-to-person telephone contact that we have not listed specifically (due to space limitations). Generally speaking, if you fax a question to a vendor's technical support department, it will be answered. The speed of response varies from company to company: Some vendors promise an answer within a specific time; others just promise an answer.

Another service that is gaining popularity is automated phone support. To handle the increasing numbers of support calls that go with a growing user base, some companies have streamlined the process by recording answers to frequently asked questions: You choose your topic from a voice menu system using a Touch-tone phone. This type of service is normally toll-free. Many software vendors also offer newsletters, technical seminars, upgrade programs, and maintenance releases. The extent and cost of these services vary.

Last, since virtually every vendor offers it, we have *not* listed the 90-day warranty that seems to be an industry standard. Warranty terms differ, however. While some companies explicitly provide no-questions-asked money-back guarantees, others merely promise to replace defective software.

CONTINUES

THE END OF THE FEATURES WAR

The features-list approach to software differentiation is essentially dead. Many of the competing packages have virtually identical features lists; the standardized graphical user interface even makes them look alike. During the coming decade, software will be increasingly differentiated by less tangible attributes: ease of use, vendor support, and perceived satisfaction. The charts and analyses provided over the next pages indicate that we're in for interesting times.

Database Management

by Rick Ayre

Nowhere is user allegiance to software more important than among database users. A database is software you must be able to depend on. End users rely on it for the safe storage of data that is critical to their business operations. For developers, the databases they use—and the applications they develop with those databases—are a primary source of income. User satisfaction, then, should be a clear barometer of success in this product category. However, according to our survey results, that's not always the case.

dBASE, formerly of Ashton-Tate, now of Borland, has held the lion's share of the desktop computer database market since it was introduced in the days of CP/M. Around *dBASE* has grown a whole community of Xbase developers, programmers, and end users. It takes only a cursory examination of the Xbase community to understand that technical support matters—in a dramatic way. Users depend on technical support staffs to get them over development or programming hurdles, as well as to help them around difficult corners in normal use.

Given *dBASE*'s market dominance, it is no surprise that we had almost twice as many responses from *dBASE* users as from users of the next most popular database, *Paradox*. We combined *FoxBase* and *FoxPro*, and together they were third in number of responses, while *Clipper* was a close fourth.

At press time, Microsoft announced the purchase of Fox Software. If the acquisition goes smoothly, Microsoft will become the number-two database vendor—behind Borland.

OVERALL SATISFACTION

Surprisingly, only three database managers managed to beat the curve when they were rated for overall satisfaction: *FoxBase/FoxPro*, *Paradox*, and *Clipper*. There was no significant difference between the ratings for *FoxBase/FoxPro* and *Paradox*, so they finish in a virtual tie for our top spot in overall satisfaction.

These three products were the only ones that garnered significantly better-than-average ratings. That means among the also-rans you'll find *dBASE* and *DataEase*—one a market leader, the other long heralded for ease of use.

It is interesting to note that two of the top three performers—*FoxBase/FoxPro* and *Clipper*—are Xbase derivatives. That would seem to indicate that there is still life in the "dialect," if not in the *dBASE* product itself. At the very least, this indicates that Borland has some work to do if

DATABASE SUMMARY

Obviously, support and satisfaction matter to database users, and our readers have clear favorites. *Paradox* is the winner, with the *FoxBase/FoxPro* duo a close second.

The year ahead promises to be an interesting one, as new products are released and old products are updated by new owners. Can Borland satisfy *dBASE* users? Will there finally be a Windows database with any kind of market momentum? Tune in next year for answers to these questions. For now, it's safe to say that DOS databases rule.

SOFTWARE VENDORS' SUPPORT POLICIES

Companies listed in alphabetical order

■—Yes ⌟—No

Vendor	Aldus Corp.	Borland International			
Product	Persuasion	Applause	dBASE	MultiMate	Paradox
Technical support number	206-628-2040	408-438-8298	408-431-9060	408-438-8298	408-438-5300
Phone support hours (E.S.T.)	10:00–7:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F
Free phone support	90 days	Unlimited	Unlimited	Unlimited	Unlimited
Toll-free phone support available	■	■	⌟	■	■
Free of extended-plan charge	⌟	⌟	N/A	⌟	⌟
900 number	■	⌟	⌟	⌟	⌟
Public BBS support available	CompuServe	CompuServe	CompuServe, GEnie	CompuServe	CompuServe, GEnie, BIX
Private BBS support number	None	408-431-2275	408-439-9096	408-431-2275	408-439-9096
Extended support plans available	■	■	■	■	■
Corporate support plans available	■	■	■	■	■

N/A—Not applicable: This service is not offered.

it wants *dBASE*'s image to match that of its other database, *Paradox*, in user satisfaction.

That the three winning products are so dissimilar is also hard to miss. *Paradox* is known for its end-user query tools, *FoxPro* for its development tools; and *Clipper* is less an application than a development environment.

SATISFACTION WITH TECHNICAL SUPPORT

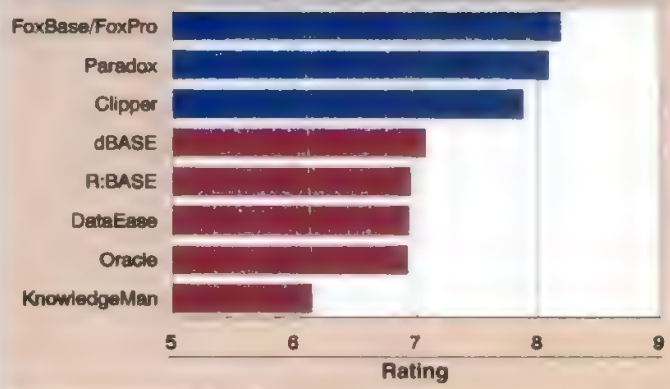
Paradox holds the top spot in our ratings of satisfaction with technical support, finishing significantly higher than the second-place finishers, the *FoxBase/FoxPro* team, although the latter pair also finished significantly better than average. *Clipper* was in the average range. Again, our respondents rated both *dBASE* and *DataEase* significantly below the average in technical support.

Since Borland is now the provider of tech support for *dBASE*, one can surmise that this rating will improve. It is impossible to tell from our data whether there is

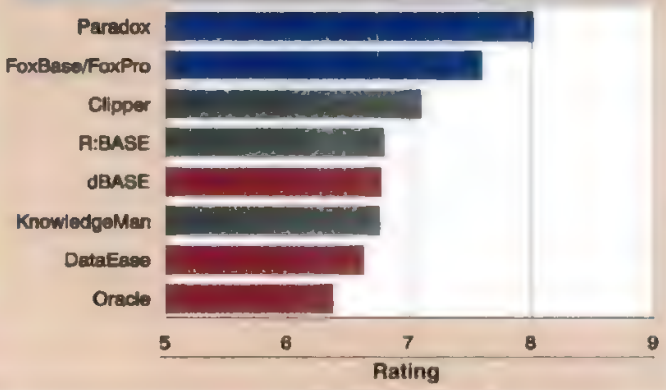
DATABASE MANAGERS: HOW THE RATINGS LOOK

The following eight charts illustrate how users responded to the survey when asked to rate software for overall satisfaction and satisfaction with technical support. Readers rated products on a scale of 1 to 10, with 10 as the highest score. Scores for individual packages were averaged (as graphed here). Each individual package's score was compared with an overall average for the category, and the difference was tested for statistical significance. This produced not an absolute ranking but a division into three groups: Individual packages are either average, significantly above average, or significantly below average.

DATABASES: OVERALL SATISFACTION



DATABASES: SATISFACTION WITH SUPPORT



	Computer Associates International	DataEase International	Fox Software	IBM Corp.	Lotus Development Corp.
Quattro Pro	CA-SuperCalc	DataEase	FoxPro	DisplayWrite	Ami Pro
408-438-5300 9:00–8:00 M–F Unlimited	408-432-1764 9:00–8:00 M–F 90 days	203-374-2825 9:00–6:00 M–F 6 months	419-872-0043 8:30–5:00 M–F Unlimited	800-336-5430 9:00–8:00 M–F Unlimited	404-399-5505 8:30–8:00 M–F Unlimited
❑ N/A ❑	■ ❑ ❑	■ ❑ ❑	■ ❑ ❑	■ ■ ❑	❑ N/A ❑
CompuServe, GEnie, BIX 408-439-9096 ■ ■	None None ■ ❑	None 203-374-6302 ■ ■	CompuServe None ❑ ■	CompuServe 214-402-5222 ❑ ❑	CompuServe 404-851-1371 ❑ ■

CONTINUES

any trend toward improved satisfaction among *dBASE* users since the Borland purchase.

Presentation Graphics

by Ted Stevenson

Of the presentation graphics software users who responded to our survey, a huge plurality remain wedded to the long-time market leader: *Harvard Graphics* (the DOS version). It was used by more than three times as many respondents in our survey as the next most popular package, Lotus's *Freelance* (again, the DOS version).

With presentation graphics, as we noticed with database management, market dominance does not coincide with preeminence in user satisfaction. While *Harvard* sells rings around the competition, users of the other packages seem to like them as well or better. Market share clearly carries with it a momentum unconnected with user satisfaction: If everybody's using it, chances are you'll use it too.

OVERALL SATISFACTION

Sharing the overall satisfaction honors with *Harvard* are two relative newcomers, Micrografx's *Charisma* and *Aldus Persuasion*, both Windows packages. Which was best? While *Charisma* and *Persuasion* actually received higher scores than *Harvard* (see the chart for actual scores), we determined that the differences among them were not statistically significant. However, all three did rate significantly above the average.

Both *Charisma* and *Persuasion* are powerful, feature-rich packages that make good use of the flexible Windows environment. Indeed, the three Windows packages as a group fared well in our survey; two of them were rated in the above-average range, whereas only one of five DOS packages (*Harvard Graphics*) had that distinction. This suggests that Windows may be on the way to becoming the environment of choice for users of PC-based presentation graphics software.

At the bottom of the overall satisfaction scale ("below average") is *Applause*, a capable product apparently suffering from a sort of orphan syndrome. Its former parent, Ashton-Tate, apparently didn't support it well, and it doesn't appear to have much of a future at Borland either.

TECHNICAL SUPPORT

Windows was apparently not a factor in users' satisfaction with technical support, however. While *Charisma* had a high raw score in this comparison, significance testing reveals that it falls, along with the other Windows packages, in the statistically average range. In fact, we were unable to discern any apparent correlation between overall satisfaction with a product and satisfaction with its technical support. These seem to be unrelated issues.

So what separates the tech support sheep from the tech support goats? Not too surprisingly, people prefer free, unlimited telephone support. However you slice the pie, regardless of the reasons vendors cite to justify charging for or otherwise limiting support, people seem to like to get it free. . .forever. The evidence? *DrawPerfect*, which ranked sixth in overall user satisfaction out of a field of seven, scored highest in customer satisfaction with support—by a significant margin.

PRESENTATION GRAPHICS SUMMARY

Presentation graphics market leader *Harvard Graphics* proved its status by the user numbers reported here, but survey results also gave credence to the notion that packages with lesser market shares can have even happier users. Can packages with lower overall satisfaction ratings turn quality tech support into market share? Tune in next year. . . .

SOFTWARE VENDORS' SUPPORT POLICIES

Companies listed in alphabetical order

■—Yes ❑—No

Vendor	Lotus Development Corp.			Micro Data Base Systems (MDBS)
Product	Freelance Graphics	Lotus 1-2-3 (DOS and Windows versions)	Manuscript	KnowledgeMan
Technical support number	800-223-1662	800-223-1662	800-223-1662	317-448-6187
Phone support hours (E.S.T.)	8:30–8:00 M–F	24 hours, 7 days	8:30–8:00 M–F	8:00 A.M.–12:00 noon, 1:00–5:00 P.M. M–F
Free phone support	90 days	90 days	6 months	90 days
Toll-free phone support available	■	■	■	❑
Free of extended-plan charge	❑ (after 90 days)	❑ (after 90 days)	❑ (after 6 months)	N/A
900 number	■	■	■	❑
Public BBS support available	CompuServe	CompuServe	CompuServe	None
Private BBS support number	None	None	None	317-447-6685
Extended support plans available	■	■	■	■
Corporate support plans available	■	■	■	■

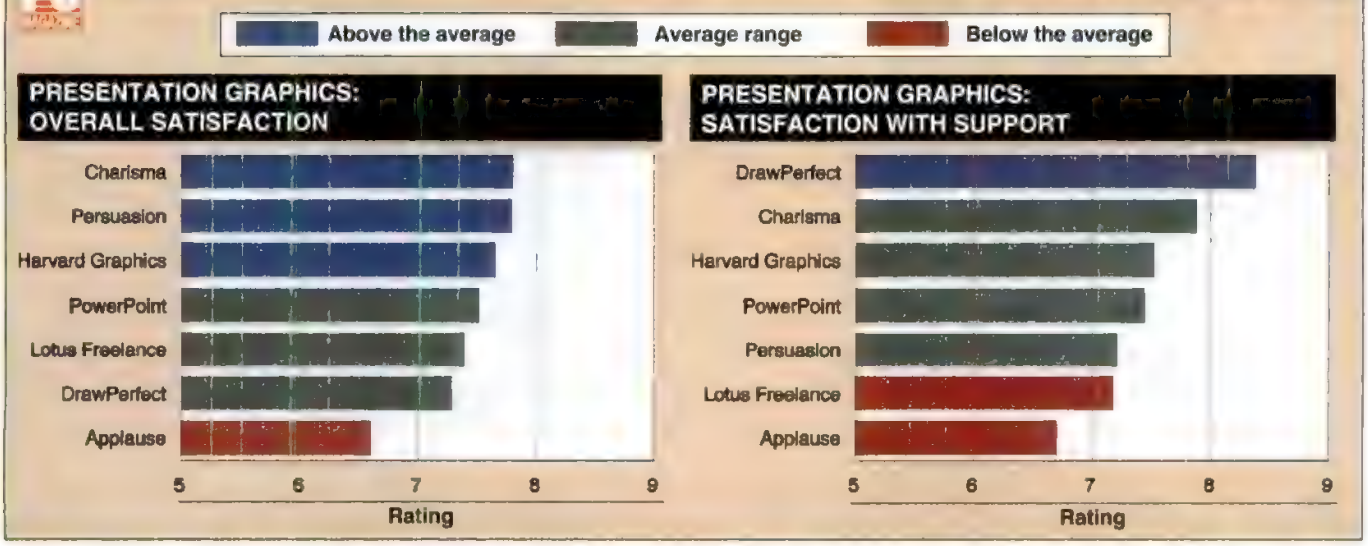
N/A—Not applicable: This service is not offered.

WordPerfect Corp., producer of *DrawPerfect,* is the only company in the presentation graphics field that offers unlimited toll-free support 11 hours a day, 5 days a week. While it is reasonable to suppose that the quality of that free phone support is also a factor in customer satisfaction levels, we were unable to measure this.

A statistically lower level of satisfaction with technical support (average) applies to another group of products—Micrografx's *Charisma,* Software Publishing Corp.'s *Harvard Graphics* (for DOS), and *Microsoft PowerPoint*—backed by unlimited phone support where you pay for the cost of the call. Also at this level is *Aldus Persuasion.* Aldus offers unlimited toll support for a 90-day period and charges thereafter.

At the bottom of the list (statistically below the average) are Borland's (formerly Ashton-Tate's) moribund *Applause* and Lotus's *Freelance Graphics* (for DOS). *Applause*'s low score may reflect Ashton-Tate's support. Borland is continuing to support the product with essentially the same policy it uses for its own products. Like Aldus, Lotus limits free phone support to 90 days and charges thereafter. Unlike Aldus, Lotus provides an 800 number for the initial support period. While again, other factors may be involved in shaping users' attitudes, our results appear to suggest a relationship between satisfaction with tech support and its cost or apparent cost to the user.

PRESENTATION GRAPHICS SOFTWARE: HOW THE RATINGS LOOK



Micrografx	Microrim	Microsoft Corp.				
Charisma	R:BASE	Excel	Multiplan	PowerPoint	Word	Word for Windows
214-234-2694 24 hours M–F; 8:00–5:00 Sat., Sun.	206-649-9551 10:00–7:00 M–F	206-635-7070 9:00 A.M.– 9:00 P.M. M–F	206-454-2030 9:00 A.M.– 9:00 P.M. M–F	206-635-7145 9:00 A.M.– 9:00 P.M. M–F	206-635-7210 9:00 A.M.– 9:00 P.M. M–F	206-462-9673 9:00 A.M.– 9:00 P.M. M–F
Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
❑	■	❑	❑	❑	❑	❑
N/A	❑	N/A	N/A	N/A	N/A	N/A
❑	■	❑	❑	❑	❑	❑
CompuServe	None	CompuServe, GEnie	None	CompuServe	CompuServe	CompuServe
214-644-4194	206-649-9836	None	None	None	None	None
■	■	■	❑	❑	❑	❑
❑	■	■	■	■	■	■

CONTINUES

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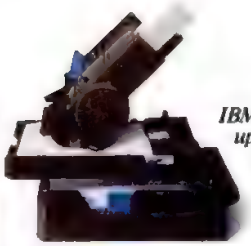
HP LaserJet III: 200-sheet limit; second tray or larger tray options not available.

HP LaserJet III printer: sorry, one tray at a time.



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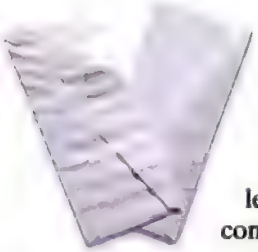

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Optional trays smoothly handle card stock, labels and overheads; a front exit keeps them flat.

500-sheet tray and front exit not available on Model 5E. HP and LaserJet are registered trademarks of Hewlett-Packard Company. IBM is a registered trademark of International Business Machines Corporation in the United States and/or other countries and is used under license. Lexmark is a trademark of Lexmark International, Inc.

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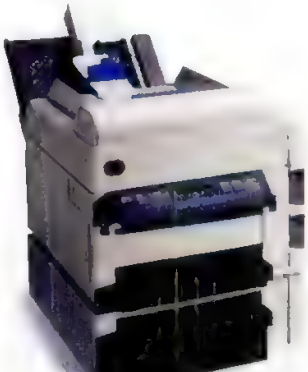

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CIRCLE 081 ON READER SERVICE CARD

PAGES AHEAD.

Spreadsheets

by Brad Grimes

Borland's *Quattro/Quattro Pro* garnered the highest score for overall satisfaction in our survey of spreadsheet users. *Quattro/Quattro Pro* and *PlanPerfect* (with WordPerfect's legendary support staff) were the highest-rated products for satisfaction with technical support. Not far behind them in either category was *Microsoft Excel for Windows*.

So where was Lotus, the name that was once synonymous with spreadsheets?

The new king of the hill could turn out to be* Quattro Pro, *rated highest for overall satisfaction.

Users were asked to rate the DOS and Windows products separately. In overall satisfaction, the DOS version of *1-2-3* was rated average. It may be that multiple releases have muddled Lotus's score for overall satisfaction, since there are many versions on users' desks and some have been less successful than others. In the Windows market, though, *Microsoft Excel for Windows* far outshone *Lotus 1-2-3 for Windows* in overall satisfaction. And when it comes to technical support, Lotus has its problems again. *Lotus 1-2-3 for DOS* scored below the average for satisfaction with technical support. The Cambridge company provides free support for 90 days, but after that, users need to pay $129 a year for toll-free support or $2 per minute for 900-number phone support.

SATISFIED

The new king of the hill could turn out to be *Quattro/Quattro Pro*, as these packages were rated highest for overall satisfaction. Apparently Borland is consistent in putting out good spreadsheet software, so the future would seem bright for *Quattro Pro* 4.0, released since our survey. For satisfaction with technical support, Borland was in the same league with WordPerfect. The call to Borland is not toll-free like the call to WordPerfect, but Borland surpasses other competitors with programs like Techfax, a 24-hour automated service through which users can call toll-free and fax themselves technical information.

PlanPerfect's score for overall satisfaction was in the average range, but free unlimited toll-free support brought it a top score for satisfaction with technical support (although not significantly higher than the other above-average ratings). These scores may indicate that WordPerfect's spreadsheet offering is not as functional as its users would like, so they're calling tech support for answers; if so, they seem to like the service they're getting. Whatever the case may be, there

SPREADSHEETS SUMMARY

Users' dislike of product-line confusion may account for *Lotus 1-2-3*'s merely average showing in overall satisfaction; too many releases lead to an unpleasant plethora of choices. For Lotus, technical support ratings held no better news than overall satisfaction; this time *1-2-3* scored below the average with users. Free support apparently boosted another WordPerfect product, *PlanPerfect*, to the top of the technical support heap.

The spreadsheet to watch may be *Quattro Pro*, which was the overall-satisfaction leader. While it did not surpass *PlanPerfect* in technical support, its numbers were in the same above-average league.

SOFTWARE VENDORS' SUPPORT POLICIES

Companies listed in alphabetical order

■—Yes ❑—No

Vendor	Nantucket Corp.	Oracle Corp.	Software Publishing Corp.	
Product	**Clipper**	**Oracle**	**Harvard Graphics**	**Professional Write**
Technical support number	310-390-7923	415-506-1500	408-988-4005	608-274-9715
Phone support hours (E.S.T.)	9:00–7:30 M–F	8:00 A.M.–9:00 P.M. M–F	10:00–7:00 M–F	10:00–8:00 M–F
Free phone support	30 days	30 days	90 days	90 days
Toll-free phone support available	■	❑	❑	❑
Free of extended-plan charge	❑	N/A	N/A	N/A
900 number	❑	❑	❑	❑
Public BBS support available	CompuServe	CompuServe	CompuServe	CompuServe
Private BBS support number	None	None	None	None
Extended support plans available	■	■	■	■
Corporate support plans available	■	■	■	■

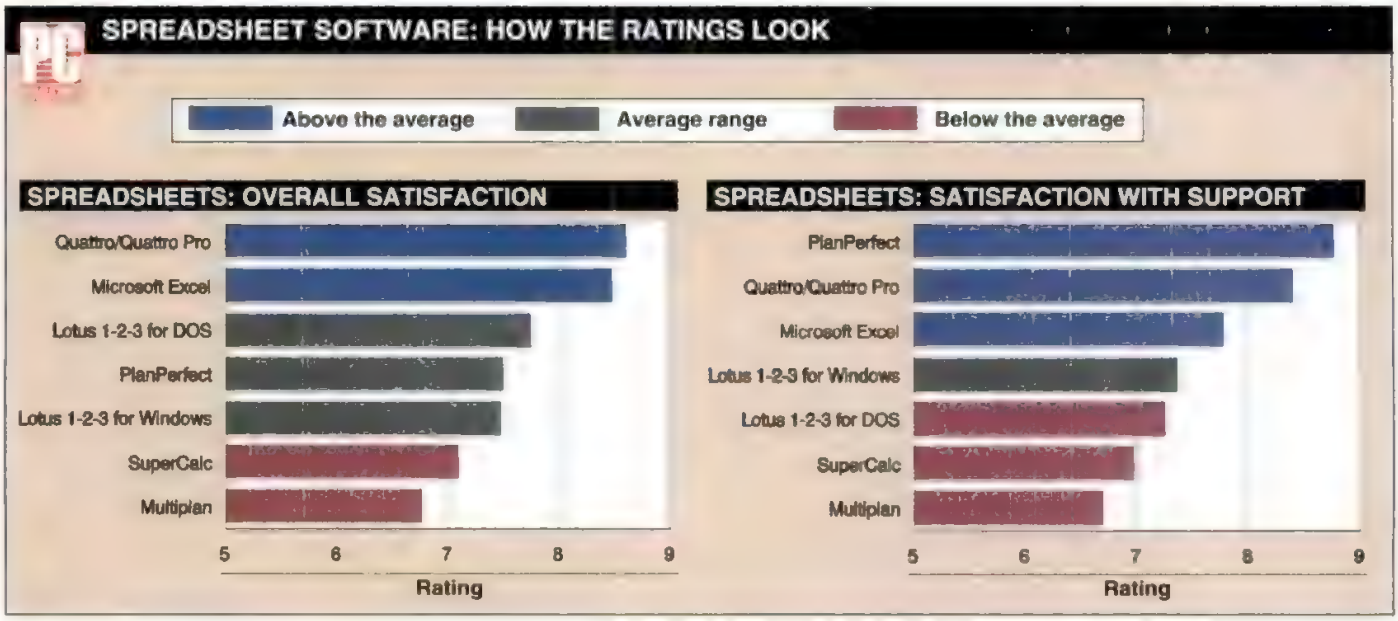
N/A—Not applicable: This service is not offered.

are few *PlanPerfect* users. Of the over 7,500 respondents who said they'd used a spreadsheet in the last two years, only 204 said that the spreadsheet they used was *PlanPerfect*. Conclusion: Stellar support alone does not make a product a best-seller.

WINDOWS SPREAD

Riding the wave of Microsoft Windows sales is *Microsoft Excel for Windows*. Though not the outright winner in either category, Microsoft's spreadsheet package made an impressive showing. It was hot on *Quattro/Quattro Pro*'s heels for overall satisfaction, and it only falls behind *PlanPerfect* and *Quattro/Quattro Pro* in satisfaction with technical support. As with Borland, there is no toll-free number to call, and Microsoft does not currently offer a service like Techfax. With the number of *Excel* users on the rise, Microsoft has reported that its support staff is inundated. The company has addressed the flood of calls by providing recorded answers to commonly asked questions about *Excel* 3.0.

CA-SuperCalc and *Multiplan* occupy the lowest spots, which is to be expected of spreadsheets suffering parental neglect. Neither product offers bulletin board support. Computer Associates has done little to upgrade *SuperCalc* over the last year, and the vendor charges for technical support after the first 90 days ($2 per minute with a minimum of 10 minutes or $75 per year for CA's SupportPlus). *Multiplan* is



	WordPerfect Corp.			WordStar International	
Professional Write Plus	DrawPerfect	PlanPerfect	WordPerfect (DOS and Windows versions)	WordStar for DOS	WordStar for Windows
608-274-4391	800-541-5098	800-321-3248	800-321-5906	812-323-0069 (Version 7.0)	812-323-0062
10:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	10:00–7:00 M, T, Th, F; 11:00–7:00 W	10:00–7:00 M, T, Th, F; 11:00–7:00 W
90 days	Unlimited	Unlimited	Unlimited	Until release of new version	Until release of new version
❑	■	■	■	❑	❑
N/A	■	■	■	N/A	N/A
❑	❑	❑	❑	❑	❑
CompuServe	None	None	None	CompuServe	CompuServe
None	801-225-4414	801-225-4414	801-225-4414	None	None
■	❑	❑	❑	■	■
■	■	■	■	■	■

ENDS

Microsoft's pre-*Excel* offering and has not received an upgrade since Version 4.2 shipped in 1989. The product does not have *Excel*'s appeal (or any of the other spreadsheets' appeal, judging by its low overall satisfaction rating), but it is supported by the same phone program as its Windows successor (minus recorded answers). It seems likely that neither *SuperCalc* nor *Multiplan* will continue to be competitive without significant development attention.

Word Processors

by Lance N. Ulanoff

More than half the word processing packages in our support and satisfaction survey scored above the average in technical support and overall satisfaction. In most cases, technical support rated equal to or higher than overall satisfaction. It looks like after struggling to meet the quality demands of the 1980s, these software vendors may have discovered an added ingredient for success in the 1990s—service.

One of the most striking conclusions we can draw from the survey results is that users appear to form opinions early, apparently basing them on prior experience with a vendor. For example, users of the DOS version of *WordPerfect* returned some of the highest support and satisfaction ratings in the entire survey. In fact, it was rated above all other packages on overall satisfaction. Sister software *WordPerfect for Windows* also boasted significantly above-average support ratings. The difference? *WordPerfect for Windows* was released just months before the survey was conducted and obviously has a much smaller user base. Yet those who have used the software for these few months felt both satisfied and well supported.

It may be that seasoned *WordPerfect* users are migrating to the Windows version and carrying their good feelings about *WordPerfect*'s legendary technical support with them. On the other hand, most users contact technical support in the first few months of owning a software package. An interesting sidelight to this is the number of respondents who report using *WordPerfect* in the last two years—more than double that of its nearest competitor.

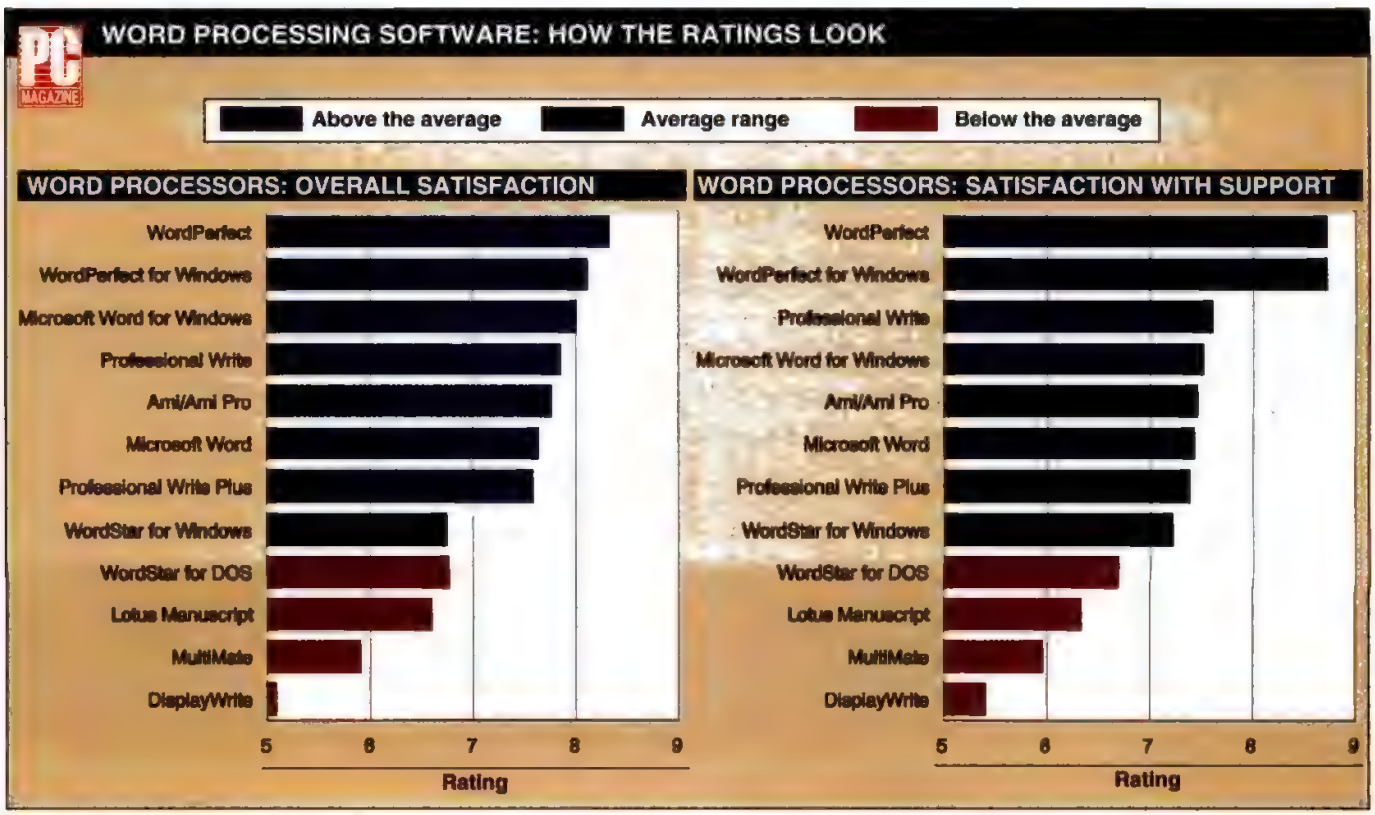
DOS VS. WINDOWS

Users seem no more satisfied with the technical support provided for Windows products than with what they get for DOS-based word processors. The major vendors scored almost equally with both their DOS and Windows versions.

In one of the most heated battles in the industry, *WordPerfect for Windows* and Microsoft's *Word for Windows* rated almost equal in customers' product satisfaction. Yet users rate *WordPerfect* sig-

WORD PROCESSORS SUMMARY

Posting some of the highest ratings and the largest number of total respondents for any product in the survey, *WordPerfect* apparently gets a lot of mileage out of WordPerfect Corp.'s technical support policies, which include unlimited toll-free help. The vendor's ability to gain customers and make them happy may account for *WordPerfect for Windows*' healthy showing. It will be interesting to see how the product fares in next year's survey. Users are apparently put off by fluctuations or uncertainty in a product's support and future, as evidenced by the below-average marks of products such as *DisplayWrite* and *MultiMate*.



While **MultiMate** *will continue to be supported by Borland, it doesn't appear to have much of a future.*

nificantly higher in technical support. Does this have anything to do with the fact that WordPerfect Corp.'s tech support line is a toll-free 800 number and Microsoft's is a pay-as-you-wait line? Probably.

Both Lotus's *Ami Pro* and the DOS and Windows versions of *Professional Write* had strong (above-average) showings for overall satisfaction. On the other hand, *Professional Write* for DOS and *Ami Pro* were rated in the average range for quality of technical support. *Ami Pro*'s standing may have been hampered a bit by Lotus's policy of free information over a standard (non-toll-free) line.

One surprise was *WordStar for DOS* and *WordStar for Windows*' below-average scores for overall satisfaction, although the Windows version posted a somewhat higher figure for technical support. *WordStar for DOS*'s technical support actually fell below the average. These scores may reflect WordStar's free-for-the-life-of-the-product-*version* support policy. Once a version has been superseded, it isn't necessarily supported further.

Going out of business seems to put a damper on support satisfaction, as the now-defunct *MultiMate* illustrates. It fell well below the average score. While *MultiMate* will continue to be supported by its new owner, Borland, it doesn't appear to have much of a future.

Although industry observers—and if we can judge by the below-average satisfaction scores on the survey, users, too—have had some doubts about the future of IBM's *DisplayWrite* and Lotus's *Manuscript*, both companies continue to sell and support these products. IBM, in fact, has announced a modified release of *DisplayWrite* 5 and 5.2 for later this year. What that will mean for their scores on next year's survey is anyone's guess. ■

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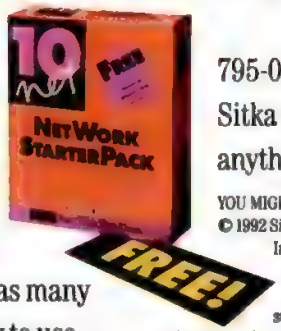

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CIRCLE 396 ON READER SERVICE CARD

Network Operating Systems Go Corporate

PHOTOGRAPHY: THOM O'CONNOR

by Frank J. Derfler, Jr.

With new internetworking and management features, LAN Manager, NetWare, and VINES can now claim to be corporate-wide computing platforms . . . or can they? Find out how they stack up and which one is right for your environment.

Darwin would have been pleased with today's network operating systems. The evolution of *Microsoft LAN Manager* 2.1, *NetWare* 3.11, and *VINES* 4.11 from young upstarts to sophisticated computing platforms bears out the naturalist's theory.

Today's leading network operating systems are offering the security, internetworking capability, reliability, and performance once associated strictly with the mainframes and minicomputers of old. Indeed, these packages are becoming the corporate computing platforms of today.

In this review, we will compare three network operating systems that account for 85 percent of all client/server LAN sales and attempt to answer the question, "Which is best suited for the corporate environment?" In truth, any analysis of network operating systems will be inade-

quate: These products are that complex.

We have chosen to focus on five increasingly important areas: security, reliability, manageability, pricing, and performance. Here are some trends that emerge:

■ **Cheaper network operating systems.** Thanks to increasing competition from low-cost LAN vendors, Novell and Banyan Systems have joined Microsoft in dropping the entry-level cost for their software to around $200 per user. (Add to that the costs for hardware and cabling.)

■ **Faster than ever.** None of the vendors took the speed title on all of our tests, but each excelled in a different area: *LAN Manager* in small workgroups, *NetWare* in medium to large workgroups, and *VINES* in server-to-server communications.

■ **Internetworking on the rise.** The increasing need to access corporate data stored on mainframes and Unix hosts has made connecting into the IBM, VMS, and Unix environments crucial. TCP/IP (Transmission Control Protocol/Internet Protocol) is the area of major interest because it is supported on many types of computer platforms, but vendors are looking at a range of approaches to connecting to other network systems.

■ **Simplicity for the network manager.** Networks are becoming simpler to install and maintain. What was once an all-day affair can now be accomplished in about an hour after formatting the server's hard disk. And with vendors focusing more on building enterprise-wide services (such as naming services) into the network operating system, managing the network is becoming easier than ever.

■ **Fault tolerance almost here.** Although most people agree that total network reliability is essential, it is not here just yet. Novell, for example, is still working on enhancing the fault-tolerance features of *NetWare* for an upcoming product, *Novell SFT III*. Still, all of these products offer either disk mirroring or disk duplexing; and with the help of third-party products, *VINES* lets you back up some services to another server.

■ **Focus on network management.** With the rise of the Simple Network Management Protocol (SNMP), there is more interest than ever in providing the tools necessary for managing networks. Novell's new SNMP station, the Network Management System (NMS), exemplifies this trend.

HIGHLIGHTS

■ Although the long-term costs of operating and maintaining a LAN add up to more than the purchase price, *NetWare* is still too costly when compared with its competition, despite recent price cuts.

■ Platform connectivity is hot. All of the products reviewed here are connecting more types of clients than ever before, including Macintoshes and Unix and OS/2 stations. Server-to-server internetworking is also being enhanced with TCP/IP support at both the client and the server levels.

■ DOS-based LANs such as *LANtastic* and *POWERLan* can achieve throughput that most users would not be able to distinguish from the speeds achieved by the network operating systems reviewed here. But on networks with hundreds of nodes, DOS-based LANs cannot handle the work load as well as these multitasking products.

■ *Microsoft LAN Manager*'s performance is now as competitive in small workgroups as *NetWare*'s, but users have reason to worry about Microsoft's future support for OS/2. *LAN Manager* displayed the best performance by far for an 8-client network, but its efficiency dropped with 16 client PCs connected. OS/2 1.3's memory limitations are probably responsible for this decrease.

■ Novell's *NetWare* offers the most comprehensive networking environment when you take into account the amount of third-party products available. *NetWare* showed good performance when we had 8, 16, and 24 client PCs on our network, but its efficiency dropped sharply when we tested it with a 32-client load. Adding more memory to the server compensated for this performance decrease.

■ Banyan Systems' *VINES* offers the most features for multiserver networks and enterprise-wide computing, and it provided the best performance when moving data between servers. But when moving data between a client PC and its locally attached server, *VINES* is not as efficient as *LAN Manager* or *NetWare*.

■ *IBM OS/2 LAN Server* will be gaining several features not available in *LAN Manager*, such as an OS/2 Presentation Manager graphical interface for more utilities and features that make it easier to manage and use large networks. *LAN Server* lacks the native Macintosh and TCP/IP support found in *LAN Manager*, but TCP/IP support is available with other IBM products.

THE MARKET

While *LAN Manager*, *NetWare*, and *VINES* have evolved to a higher order, a number of different vendors have jumped in to fill the void. Low-cost LANs, such as Artisoft's *LANtastic* and Performance Technology's *POWERLan*, differentiate themselves largely by using DOS to manage the hard disk in the server. Consequently, though these products rival *LAN Manager*, *NetWare*, and *VINES* in the performance of a single task, the lack of a multitasking environment inhibits the DOS-based LANs from successfully running multiple applications simultaneously. In addition, *LAN Manager*, *NetWare*, and *VINES* can use their multithreaded environments to dedicate separate processes to security and print-server and file-access activities; DOS-based LANs do not offer these capabilities.

Thus, *LANtastic* and *POWERLan*, although Editors' Choice winners in our recent low-cost LANs evaluation, are not well suited for running the sophisticated client/server applications and network management programs available for the more powerful network operating systems (reported in "LAN Fundamentals, Part 2: Low-Cost LANs Grow in Features and Performance," *PC Magazine*, April 14, 1992). Here are more details about trends in the network operating system market.

LOW-COST LANs LOWER PRICING

Microsoft, Novell, and Banyan have responded to the emergence of low-cost

LANs by trying new pricing and packaging strategies that make these high-end network operating systems appealing to buyers who might have settled for less a few months ago. DOS-based LANs typically run $370 per node, including the software, LAN adapter, cabling, and connector. The network operating systems reviewed here have long cost twice that amount for networks of 2 to 50 nodes.

That seems to be changing, however. Last January, Banyan, a company that typically focuses on installations with hundreds of nodes, introduced 5-, 10-, and 20-user versions of *VINES* at prices that average about $250 per node for the software alone.

In the same month, Novell announced a new $1,095 5-user version of *NetWare* 3.11; previously, you had to start with a 25-user package. *LAN Manager* has always had a low entry point with a $995 5-user package (and now in Version 2.1, a $1,995 10-user package). Upgrading users is easy and does not require reinstalling the software, as it did with older versions of *NetWare* 2.*x*. With *LAN Manager* 2.1 and *NetWare* 3.11, you only have to copy a new version of an upgrade utility or server program onto the server, configure the number of users, and reboot the server. With *VINES*, there is a special key used to upgrade to more users. This key is a piece of hardware that inserts into the parallel port and tells the network operating system how many users to add to the system.

Products such as Artisoft's *LANtastic* are still much less expensive for small networks and less complex than *LAN Manager*, *NetWare*, and *VINES*. But if you want a clear migration path or if you want to set up a compatible network for a small workgroup away from the main operation site, high-end network operating systems now have a reasonable start-up cost.

SPEED IS STILL A FACTOR

Our testing evaluated both client-to-server and server-to-server performance. We did discover differences in performance among the three products, but all offered adequate speed for most office applications. The major factors affecting performance were the network drivers, caching techniques, and amounts of memory.

NetWare, for example, queues all hard disk activity so that the heads move sequentially and linearly, instead of randomly, to satisfy read and write requests

RATING THE PRODUCTS: SUITABILITY TO TASK

The network operating systems reviewed here provide a wide range of services, from connecting Macintoshes to interfacing with uninterruptible power supplies. The products all showed strong support for different clients, such as Macs and OS/2 stations. Administrative capabilities and security were also well supported.

Mac-to-server connectivity reflects the ability of the network operating system to support a Macintosh connection. Macintosh users should be able to log on to the network using the Mac's Chooser interface, run applications on the server, and print out files from a Macintosh word processing program to a network printer.

DOS-to-Unix connections represents the network operating system's support for DOS-to-Unix connections via TCP/IP. From the DOS client, network users should be able to open a Telnet/FTP (File Transfer Protocol) session on the Unix server and edit a Unix document on the server. In addition, users should be able to mount the file server from a Sun workstation, edit a file containing IP addresses, use the FTP command to copy a document to the server, and print a document.

OS/2 connectivity is a rating of the network operating system's ability to install OS/2 and OS/2 word processing software on the system server, bring up a file with the OS/2 word processor, and print a file on a network printer.

UPS reflects the product's suitability for managing an uninterruptible power supply connected to the server. With the UPS management program, you should be able to set an alarm that alerts you when power is interrupted and set a threshold level at which the server performs an orderly shutdown if normal power stays off for a specified time interval. In addition, the network operating system should display warning messages on the server and client screens before shutdown.

Administration represents the ability of the network operating system's management utility to create groups, give different users the rights to those groups, create unique printer queues for each group, and allow users to redirect printer output to their queues. The product's management utility should also set a password for each user and force users to change their passwords once a week.

Security reflects the product's network supervisor utilities and an administrator's ability to use them to create user names and a Bindery of security information. The supervisor utilities should let an administrator see each user's password, override encrypted passwords, and force users to change their passwords periodically or at subsequent log-ons. In addition, network supervisors should be able to create user names, users' passwords, and published resources for local PCs. Administrators should also be able to store each user's published resources to a log-on script and generate a list of resources being used, a list of users, and an error log.

SUITABILITY TO TASK Product Name	
Mac-to-server connectivity	●●●●
DOS-to-Unix connections	●●●○
OS/2 connectivity	●●○○
UPS	●○○○
Administration	N/A
Security	●○○○

4—Excellent
3—Good
2—Fair
1—Poor
N/A—Not applicable: The product does not perform this task.

as they arrive from the clients.

Sometimes the protocol made the difference. The NetBEUI (NetBIOS Extended User Interface) protocol, used by *LAN Manager*, handles larger frames than the protocols in *NetWare* or *VINES*. Thus, *LAN Manager* can perform with a single data transfer what its competition needs multiple transfers to accomplish.

All of these network operating systems can handle data from at least four LAN adapters in the server. This feature allows you to spread the network traffic over different physical cable systems to increase throughput and avoid congestion (reported in "486/33 File Servers," *PC Magazine*, March 17, 1992).

INTERNETWORKING

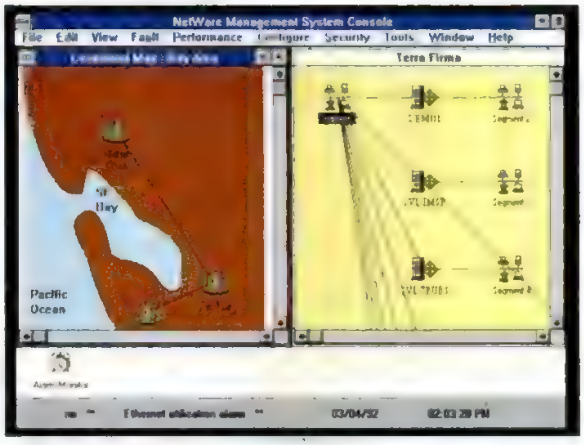
There is more to these products than fast server software. Vendors now provide the necessary hooks for linking today's network operating systems with other environments. In the past year, *LAN Manager*, *NetWare*, and *VINES* have added various internetworking capabilities. *VINES* is the leader in this area.

The most common approach is to enable a client or server to communicate over multiple network protocols simultaneously. A *NetWare* server, for example, can speak IPX/SPX (Internetwork Packet Exchange/Sequenced Packet Exchange) or TCP/IP with equal fluency to other servers. Both *LAN Manager* and *VINES* allow you to replace the server's standard protocol stack with IP.

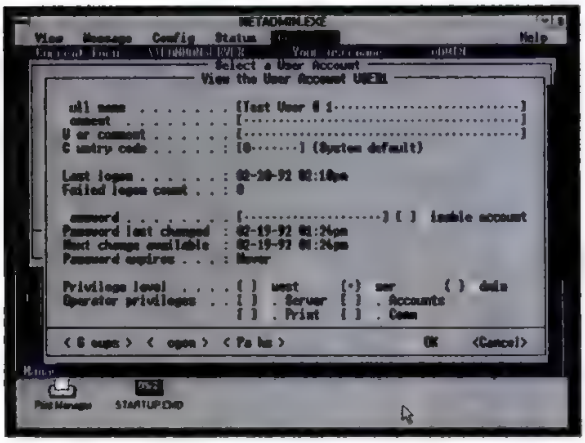
All of the products in this review enable their client PCs to establish a session with multiple servers using different protocols. Someone sitting at a PC logged on to the network, for example, can see a *NetWare* server as the F: drive and a *LAN*

NETWORK MANAGEMENT TOOLS IN ACTION

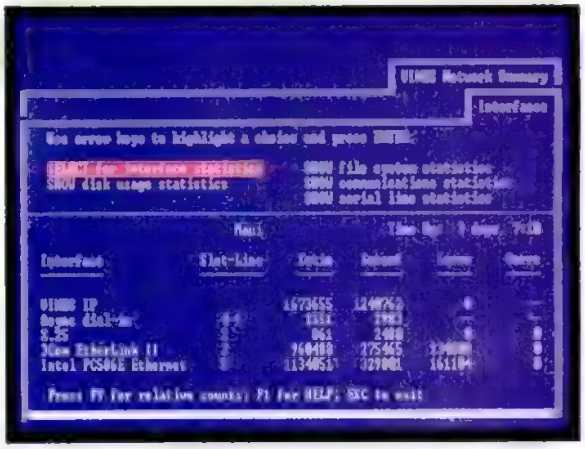
The administration tools in *Microsoft LAN Manager*, *NetWare*, and *VINES* range from simple statistics screens to illustrative maps that can take advantage of a graphical user interface. No matter what approach these network operating systems take, they are all capable of displaying detailed information about the setup of your network and its users, while giving you the ability to configure user accounts and security extensively.



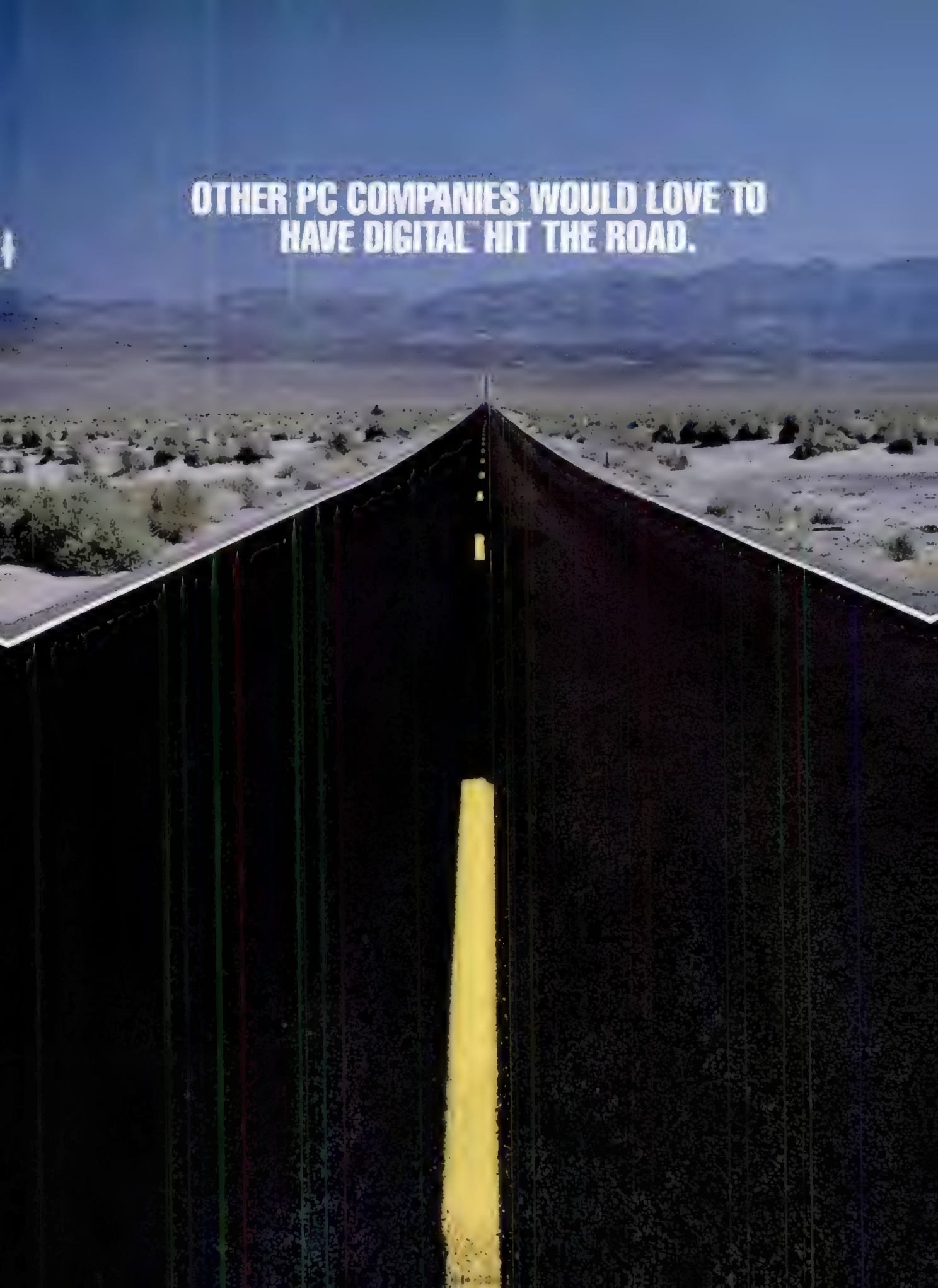
The *NetWare* Management System helps you supervise networks at related sites. The left half of this screen shows a map of Novell's Bay Area development sites. Double-clicking on the Sunnyvale icon at the bottom of the Bay Area map produces the logical network map displayed on the right half of the screen.



***Microsoft LAN Manager*'s NETADMIN lets you perform user administration tasks. You can set or change a user's encrypted password, access levels, and path to the user's home directory.**



The *VINES* MNET program uses a client/server architecture to gather statistics from any server on the network. A series of menu selections guides you to preformatted screens. The presentation is not fancy, but the information is timely and practical. In this screen, MNET shows statistics about the interface adapters, including an X.25 link and two different Ethernet adapters in the server.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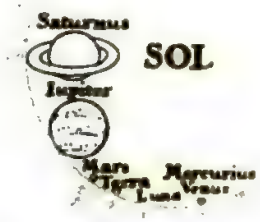

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Your base system is a: ☐ 286 ☐ 386 ☐ 486 ☐ Other

How many applications will your PC(s) run in a typical workday? _____

What best describes the type of work the system will be used for? (Check all that apply)

- ☐ Word Processing
- ☐ Order-entry
- ☐ Database (filing records)
- ☐ Financial Calculations
- ☐ Retail Store Management
- ☐ Desktop Publishing
- ☐ Education
- ☐ Design (CAD/CAM)
- ☐ Engineering
- ☐ Industrial Process Control
- ☐ Scientific Research
- ☐ Software Development
- ☐ E-Mail
- ☐ Other industry-specific applications (please specify)

How many people work in your group, department or small business?
☐ Less than 10 ☐ 10-20 ☐ 20-35 ☐ More

Is your operating system:
☐ DOS ☐ DOS with Windows ☐ OS/2 ☐ MAC ☐ UNIX™ ☐ Other

Which of the following graphics-oriented applications best describes your needs? (Check all that apply)

- ☐ Desktop Publishing
- ☐ CAD/CAM
- ☐ Realtime Modeling
- ☐ Animation
- ☐ Image Processing
- ☐ AutoCad
- ☐ Business Graphics

LAN Communication

How many PCs do you have installed? _____ From how many manufacturers? _____

What kinds of connections does your PC(s) require? (Check all that apply)

- ☐ Links with other PCs in the immediate surroundings
- ☐ Connection to the local area network (LAN) throughout a building
- ☐ A line to a host system in a remote location

What kind of media (cable) is used in your LANs today? _____

What is the networking software now being used in your company? _____

What kind of host system will your PC communicate with?
☐ DECpc ☐ IBM ☐ Other _____

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Do you currently have a service contract(s) for your PCs? How many? _____

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- *Is there a service facility?*
- *Are manufacturer's warranties handled through the company?*
- *Does the seller have formal return and refund policies?*
- *Is there an additional charge for use of credit cards?*
- *Are credit card charges held until time of shipment?*
- *What are shipping costs for items ordered?*

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- *Establish that the item is in stock and confirm shipping date.*
- *Confirm that the price is as advertised.*
- *Obtain an order number and identification of the sales representative.*
- *Make a record of your order, noting exact price including shipping, date of order, promised shipping date and order number.*

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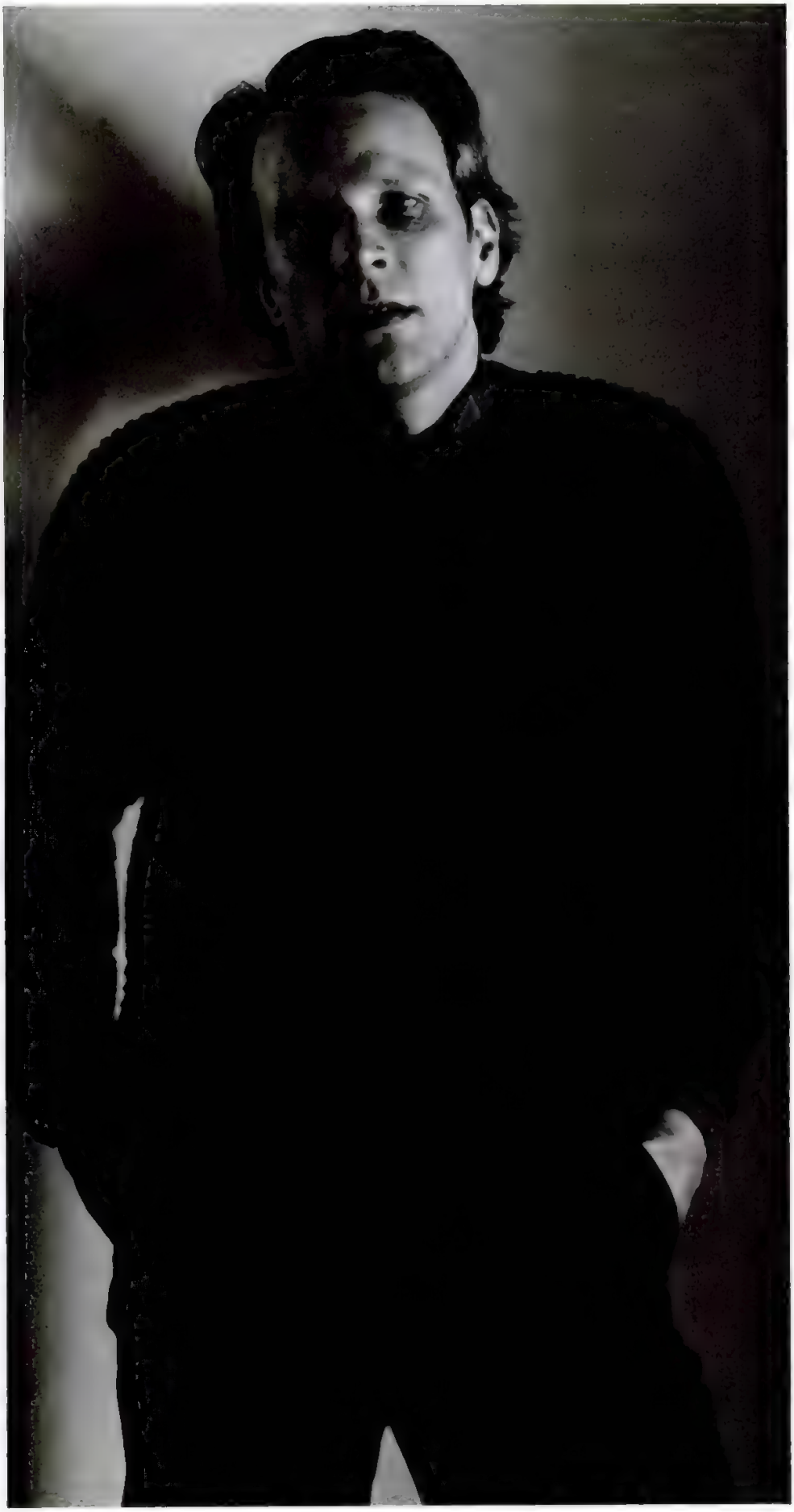

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Manager server as the G: drive.

The key to this capability lies in the device driver specifications espoused by Microsoft and Novell: Microsoft and 3Com's Network Driver Interface Specification (NDIS) and Novell's Open Datalink Interface (ODI).

Device driver specifications also free hardware developers from the need to write separate drivers for each protocol stack. They can write one driver to a given specification, and the driver will work, at least theoretically, with every protocol stack supported by that specification.

As you might expect, *LAN Manager* uses NDIS while *NetWare* uses ODI. *VINES* also supports NDIS. *NetWare* and *VINES* also come with drivers for some popular adapters.

In the Macintosh environment, Microsoft, Novell, and Banyan added support for the AppleTalk protocol used by the Macintosh. These products need no special driver specification to run multiple protocols at the client. We detailed these capabilities in "Across the Great Divide: PC-to-Mac Connections" (*PC Magazine*, May 12, 1992).

For internetworking, Novell sells a $995 multiprotocol router for *NetWare* that routes AppleTalk and the IP portion of *NetWare*'s TCP/IP protocol through the server. IP routing is a $1,995 option for *VINES*. *LAN Manager* servers can inherently route AppleTalk, but not IP. You can also buy versions of *NetWare* and *LAN Manager* ported to other operating systems such as Unix or Digital's VMS. This means, for example, that a VAX computer can become a server for a network of PCs running DOS.

Both *NetWare* and *VINES* use a technique called *IP tunneling* to enable clients to access Novell or Banyan devices across the IP network. Networking software in the client takes packets with the native proprietary protocol of the operating system, either Novell's IPX/SPX or Banyan's *VINES* Internet Protocol (VIP), and wraps the packets inside IP packets. The networking software then moves the encapsulated packets across a TCP/IP backbone for delivery to a node that can strip away the outer envelope and use the IPX or VIP packet. Under *VINES*, you can use another type of tunneling to move TCP/IP traffic across *VINES* networks by encapsulating IP packets within VIP packets. Tunneling allows TCP/IP applications and devices to use the standard IPX or VIP routers and other network services.

GOING GLOBAL

Now that they have established connections between workgroups, Microsoft and Novell are starting to provide *LAN Manager* and *NetWare* with the facilities they need for treating the enterprise-wide LAN as a cohesive unit—facilities that *VINES* has long offered.

One important server-based feature is a global naming service. Each of the three operating systems in this review offers a global naming service, but *VINES'* StreetTalk is the most comprehensive. Novell offers the *NetWare Name Service* as an optional $1,995 software product, and a naming service is built into *LAN Manager*. But the *NetWare* and *LAN Manager* services mostly handle user and group names. Neither gives you the additional information about network resources and the directory service that StreetTalk provides.

All of the products offer powerful management platforms that let you monitor and gather reports on applications running on the server.

Functionally, a global naming service groups servers into *domains*, or groups with a common interest such as an accounting department. One log-on server typically handles security control for all servers within its domain. In contrast, DOS-based LANs require users to log on individually to each server and network resource.

Within the domain, users access all resources through relatively simple resource names instead of complex multilevel names linked to specific servers. Under *VINES*, the domain can reach across the entire extended network.

VINES servers frequently update a replicated database of users, resources, and nicknames so that logging on to any server gives full access to the network. *VINES* also provides a global lookup service for locating a specific resource, something that both *LAN Manager* and *NetWare* currently lack.

FAULT TOLERANCE

Going global means that resources must be available when a user needs them. It also entails ensuring that the network can function with the reliability of a phone service. At the heart of that service is server reliability. Fault tolerance is an emerging feature for all three network operating systems.

Safety features range from monitoring the operational status of an uninterruptible power supply attached to the server, to mirroring disk drives or drive controllers to ensure continued operation if one fails, to server duplexing, where you run a separate computer as a constant hot standby for fail-safe operation.

Disk duplexing is another fault-tolerance technique that maintains mirrored disks by using separate controllers, thereby eliminating another potential point of failure. *NetWare* 3.11 includes all of these capabilities except server duplexing, which is currently being developed by Novell for its upcoming product, *Novell SFT III*. Third-party vendors offer products that add strong fault tolerance to *VINES*, but the standard program has little built-in capability. *LAN Manager* has a good repertoire of features for fault tolerance, but these are not as easily managed as those in *NetWare*.

NETWORK MANAGEMENT

With networks growing in size and complexity, network managers need a way to control and monitor an enterprise-wide network better. All of the products in this review offer powerful management platforms that enable you to monitor and gather reports on applications running on the server. Check the reviews for descriptions of these products' management capabilities.

All of the products offer support for the mushrooming SNMP, and in the cases of *LAN Manager* and *NetWare*, the products also support IBM's competing solution, the NetView management system. *NetWare* also supports Common Management Information Protocol (CMIP). Originally developed for the TCP/IP community, SNMP has emerged as the leading protocol for managing heterogeneous networks.

Under SNMP, network devices as diverse as wiring hubs, routers, and servers gather operational data into a database called a management information base (MIB). Computers running Unix or Microsoft Windows use SNMP management software to collect the contents of each MIB across the network and compile the data into snapshots or historical reports. NetView is a more complex network management system that uses intermediate levels of computers to gather reports from NetView-capable devices and relay them to programs running on IBM mainframe computer equipment.

One of the most exciting developments during the past year in network management is Novell's Hub Management Interface (HMI). HMI is a specification that integrates the wiring hub, the center of many Ethernet and Token-Ring cabling schemes, and the file server into a common device.

Putting the wiring hub inside the server reduces costs because there is no cabinet or power supply and the server's CPU runs the hub management software. Wiring hubs also make it easier for vendors to ship ready-to-run networks, complete with preconfigured file servers.

Depending on the configuration, however, there may be drawbacks to integrating the hub and server: The hub/server can create a central point of failure. You also will not be able to insert and remove hub cards from the file server on the fly.

Nevertheless, wiring hubs enable you to correlate network operating system information with information about the physical infrastructure. If the network is failing, a management application will be able to determine whether it is the server or the network itself that is causing the error.

Look for HMI products in the near future from Cabletron Systems, Chipcom, David Systems, Exos, Intel, Proteon, Standard Microsystems, Synoptics, 3Com, and Ungermann-Bass.

IBM OS/2 LAN Server: More Features and Power on the Way

by Joe Salemi

The current version of *IBM OS/2 LAN Server* (1.3) is almost two years old, but IBM is far from abandoning its development. Version 2.0 was in beta testing at the time of our review, so we could not run it through our benchmark tests, but we had an opportunity to view its new features, which include Ethernet support and the Presentation Manager interface for some utilities.

LAN Server 2.0's code is based on *Microsoft LAN Manager* 2.0. They can work together on the same LAN, and *LAN Server*'s compatibility with *LAN Manager* application programming interfaces (APIs) and Named Pipes lets you use applications written for *LAN Manager* on a *LAN Server* network. IBM added two enhancements, aliases and Dynamic Resource Sharing, that make it easier to administer large networks and are not present even in *LAN Manager* 2.1. But *LAN Server* does not have some features offered by Microsoft, particularly Macintosh and built-in TCP/IP support.

The first difference between *LAN Server* and *LAN Manager* becomes apparent during software installation. IBM rewrote the installation and configuration programs to use the familiar Presentation Manager graphical user interface and provided a PM on-line reference and help guide. The log-on, log-off, and fault-tolerance utilities are now PM programs as well. Most server administration utilities, however, remain in character mode.

The major difference between *LAN Manager* and *LAN Server* is IBM's addition of Dynamic Resource Sharing. When *LAN Manager* administrators create a shared resource, the program enters the share name into a static table. The number of active shares on a server is limited by the "maxshares" parameter in the LANMAN.INI file, up to a maximum of 500. On file servers with large hard disk subsystems or numerous shared resources, you can easily reach this limit.

IBM has solved this problem in *LAN Server* 2.0 by letting administrators create a dynamic resource. You enter the share name of the resource into a separate table, and *LAN Server* does not actually create the share until a user requests it. When the user finishes with the resource and unlinks from it, *LAN Server* removes the share from the table, freeing the slot it occupied. Through judicious use of static and dynamic shares, you can configure the network to support a virtually unlimited number of shared resources, while minimizing server downtime.

EASIER RESOURCE ACCESS

Another enhancement *LAN Server* offers over *LAN Manager* is extending alias name support to shared resources. The network administrator can define a one-word alias for any resource in the domain, regardless of where the resource resides, and the domain controller will complete the link. Users just have to remember what they want to use: choosing the HPLASER instead of the \\MAINSERVER \HPLASER1, for example.

IBM is also actively working with a number of vendors, including AST, CompuAdd, Compaq, Olivetti, NCR, and Tandy, to certify their systems for use as both servers and client PCs. We could install and run IBM's OS/2 1.3 and *LAN Server* 2.0 without problems on our Compaq Systempro, while the OS/2 1.3 included with Microsoft's *LAN Manager* 2.1 refused even to install on the same Systempro (see the *LAN Manager* review for more details).

Still missing from *LAN Server* is support for Macintosh clients, which is offered by *LAN Manager;* IBM plans to add it soon. IBM also does not include support for TCP/IP in the base *LAN Server* package, but a separate TCP/IP package is available for an additional cost. *LAN Manager* includes support for TCP/IP connections with other *LAN Manager* servers, but not for non-*LAN Manager* servers.

UPGRADE DIFFERENCES

LAN Server 2.0's enhancements over *LAN Server* 1.3 include NDIS support for network adapters, addition of the HPFS386 file system to provide enhanced performance and file security on the LAN server, disk fault tolerance through disk mirroring or duplexing,

WHERE THEY ARE HEADED

Network operating systems, as we know them today, are in the midst of a fundamental change. Instead of two distinct products—the network operating system and the operating system—the next-generation operating systems will offer built-in networking hooks. The network operating system may become a server solution only, while you will get the client PC hooks from Windows or DR-DOS. Microsoft reportedly will include intrinsic networking capabilities in a future version of Windows, taking advantage of a Windows feature called *Service Provided Interfaces* to create dynamic link libraries (DLLs) that support the directory services of various network operating systems.

Today, fully integrating the *LAN Manager, NetWare,* or *VINES* client PC software into a PC running Windows involves loading patches, using third-party products, and many other workarounds. The idea of a universal Windows client, perhaps integrated into the server software with a special software option, as in the Macintosh today, certainly appeals to Microsoft, and it presents no problems for Banyan Systems with its unique enterprise architecture. To Novell, however, this approach means losing any presence in the client PC, perhaps a blow to its plans for the acquired DR-DOS.

While the client may undergo a radical face-lift, server software will likely undergo its own changes. Most radical of these will probably be the introduction of network operating systems that can take advantage of multiple processors.

Today a network operating system's file and print server functions typically do not stress the server's CPU. Instead, servers are limited by the time needed to access the hard disk and move the data to and from the adapter cards. But when you add network management functions and database management software to the server, the CPU can become the site of the bottleneck.

One approach to the problem is to develop faster CPUs. The 80586 is surely a step in this direction. Another approach is to move the network operating system onto a computer with multiple CPUs, such as one of Compaq's Systempro line. But the developers of *LAN Manager* and *NetWare* have almost ignored this hardware capability; only *VINES* can balance the processing load between two CPUs on specific hardware platforms. Microsoft states that its planned Windows NT operating system is designed for symmetrical multiprocessing.

Instead of two distinct products—the network operating system and the operating system—the next OS generation will offer built-in networking hooks.

MULTIPROCESSING

Symmetrical multiprocessing evenly splits the load between multiple processors on a first-come, first-served basis. Asymetrical processing sends specific tasks, such as printing, to each processor. But so far network planners are not clamoring for multiprocessing capability.

As client PCs load multiple protocol stacks and we see the rise of more univer-

UPS support for automatic server shutdowns, better support for Microsoft Windows, and the ability to boot DOS or OS/2 1.3 or 2.0 client PCs from the file server. *LAN Server* 2.0 will be available in two versions. The Entry Level configuration runs under OS/2 1.3 or 2.0 on the server, but it lacks HPFS386 and fault-tolerance features. The Advanced Level configuration includes these features, but it runs only under OS/2 1.3. IBM plans to release an advanced version for OS/2 2.0 later this year.

ETHERNET AND TOKEN-RING

LAN Server 2.0 extends the remote-boot facility to support OS/2 2.0 client PCs, and the program now works on Ethernet in addition to Token-Ring. The package includes Requester software for clients running DOS 3.3, 4.01, and 5.0; Windows 3.0; and OS/2 1.3 and 2.0. OS/2 Requesters are new to this version (under *LAN Server* 1.3, you had to purchase OS/2 Extended Edition to get them), and IBM has also removed the limit of 128 DOS Requesters from the package.

LAN Server 2.0 uses OS/2 for concurrent access to a *NetWare* server from a *LAN Server* client. IBM has announced that it will extend this support to give users transparent access to both networks from a single log-on. In addition, the included migration utilities, for user account information and other data, ease the process of upgrading from prior versions of *LAN Server*.

With the current uncertainty over the future direction of Microsoft's *LAN Manager,* IBM has stepped in to pick up the ball and ensure that the current capabilities of *LAN Manager* will continue to be available and enhanced under OS/2. LAN customers who are committed to OS/2 as a server platform will have no problems using *LAN Server* 2.0 as an alternative to *LAN Manager,* and they may find that the alias support for shared resources and Dynamic Resource Sharing make administering the LAN a much easier process. Unless your network needs Macintosh support, *LAN Server* is the better choice. ■

***IBM OS/2 LAN Server,* Version 2.0**
IBM Corp., Old Orchard Rd., Armonk, NY 10504; 800-426-2468, 914-765-1900.
List Price: Entry Level, $795 with $75 fee per client; Advanced Level, $2,295 with $75 fee per client.
Requires: Entry Level server: 286-based PC or better, OS/2 1.3 or 386-based PC or better, OS/2 2.0. Advanced Level server: 386-based PC or better, 5MB RAM, 30MB hard disk, OS/2 1.3. 8MB RAM or more recommended. Client: 390K RAM (for full-screen mode), network card, DOS 3.3, 4.01, or 5.0 or OS/2 1.2 or later.

CIRCLE 506 ON READER SERVICE CARD

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The story of one company's rise to major success with the help of the world's friendliest database.

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Fortunately, we found Q&A.

Arthur, our business consultant, recommended Q&A as an easy-to-use database that would help us manage our growing business, without losing us in a maze of complexity.

Q: Where are the sales figures you need right this minute?

```
Show me a list
of sales made on April 7th
by region.
```

A: The Intelligent Assistant™ knows. Just type your request in plain, everyday English. You'll see the answer in seconds.

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Q: How can you turn your customer list into a powerful selling tool?

A: Instantly. With Q&A's built-in word processor you can easily produce personalized mailing labels and letters.

Q&A gave us such control over our business, we knew we'd be ready for anything.

And we were. The success of our *Mr. Mystery Maze* sparked a nationwide puzzle craze that

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pushed our sales to a record high. To handle it, we hired an assistant. Because of Q&A's simple, intuitive design, he was up on it in no time—with no costly training.

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8.6 Rating, 7/15/91 · 12/17/91 · 1988, 89, 90, 91

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A: It's easy; just type an entry form on the screen to create the file. And keep going.

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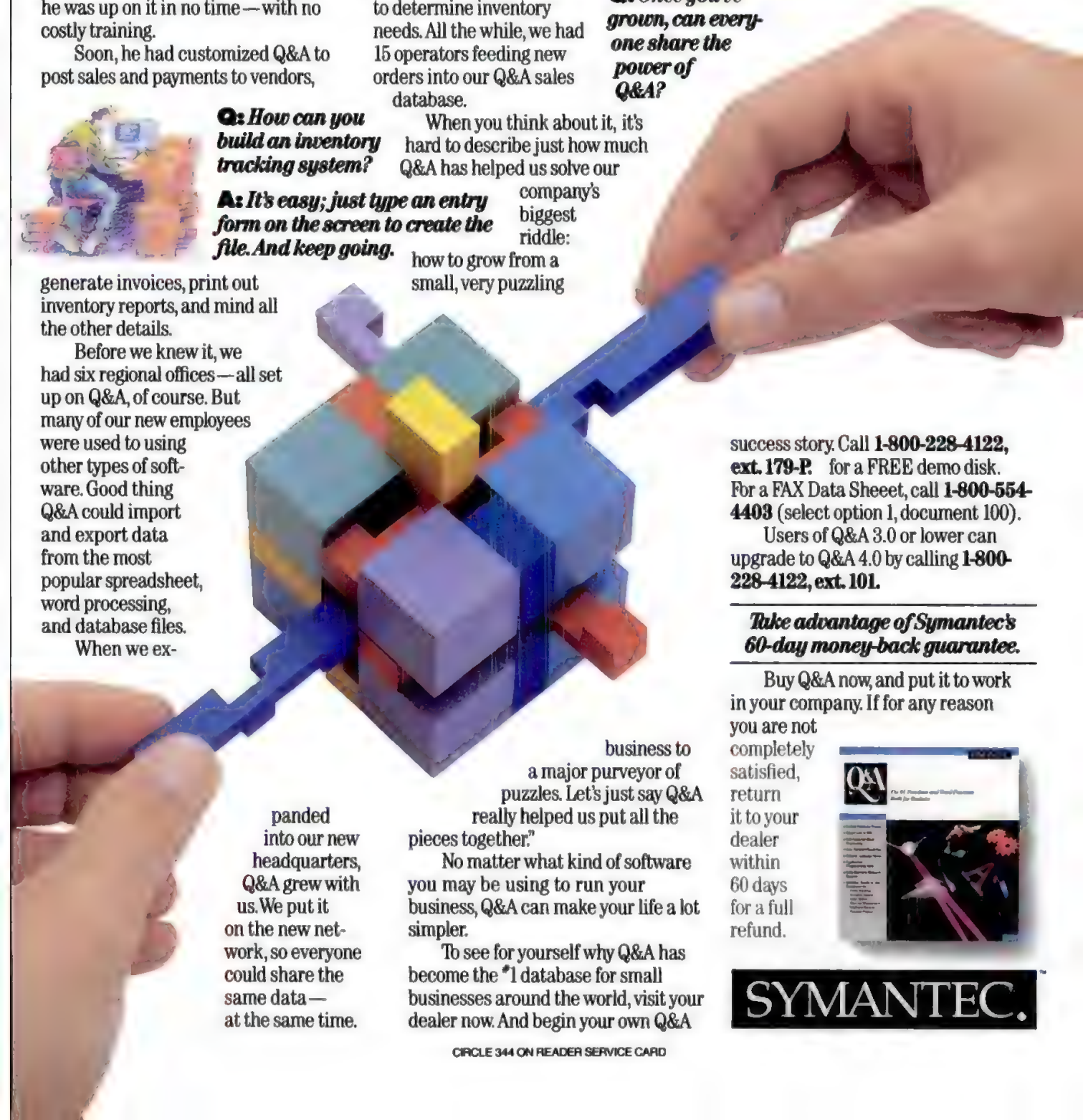
Users of Q&A 3.0 or lower can upgrade to Q&A 4.0 by calling **1-800-228-4122, ext. 101.**

Q: Once you've grown, can everyone share the power of Q&A?

A: Yes, Q&A lets multiple users share data over a network. No matter how big you get, Q&A grows with you.



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sal clients such as Macintoshes and PCs running Windows, all servers will look and act alike to the people who are using the resources. The developers of server software will focus on comprehensive management capabilities, the ability to add database and communications services internetworking between network environments, and the system reliability features that are necessary for mission-critical applications.

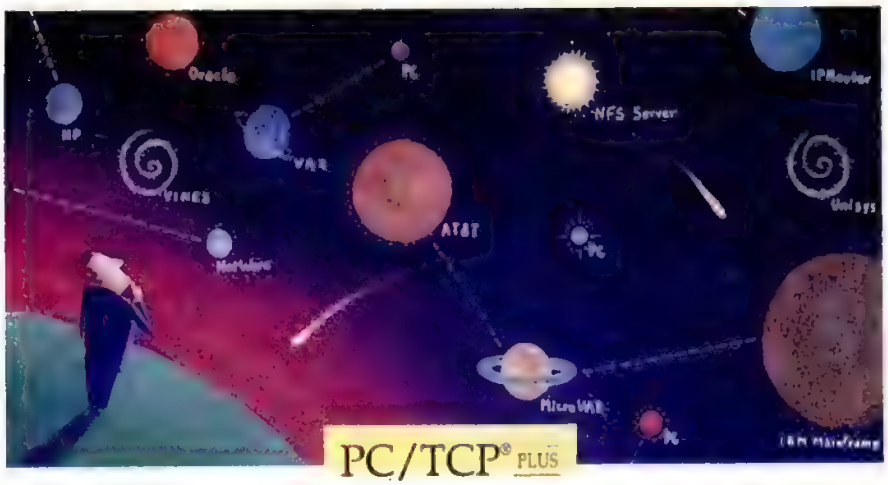
REVIEW CRITERIA

In this review we examine the network operating systems that use proprietary file-handling software to create powerful and typically dedicated servers and offer features such as database engines that run in the server. These top-end network operating systems provide extensive network management capabilities and features for multiserver operation such as a global naming scheme.

We look at *Microsoft LAN Manager*, Version 2.1; Novell's *NetWare*, Version 3.11; and Banyan Systems' *VINES*, Version 4.11. Banyan has since released *VINES*, 5.0, which includes support for the platform. The company was not, however, shipping Version 5.0 at the time of this review. Microsoft OEMs *LAN Manager* to a number of vendors, including Digital Equipment Corp., IBM, and Ungermann-Bass. We also look at IBM's version of *LAN Manager*, *IBM OS/2 LAN Server* 2.0, in a sidebar, since it was still only available in a beta version (see "IBM OS/2 LAN Server: More Features and Power on the Way").

The following reviews evaluate the top network operating systems. Each product excels in its own way: *LAN Manager* in its pricing and versatility, *NetWare* in the comprehensiveness of its environment, and *VINES* in its internetworking capabilities. Therefore, we are not designating an Editors' Choice award to any of the three. They all can be the right solution, depending on circumstances.

There's only one way to get around out here.



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*PC/TCP Plus supports interfaces from Acer, Allied Telesis, Apricot, AT&T, BICC, DEC, D-Link, DSC, Excelan, Gateway Communications, IBM, IMC Networks, Intel, Interlan, Longshine, MCAssociates, National Semiconductor, Novell, Proteon, Schneider & Koch, Scope, 10Net, 3Com, Tiara, Torus, TRW, Ungermann-Bass, Univation, Western Digital and VCS, in addition to the ASI, NDIS and Packet Driver specifications.

CIRCLE 031 ON READER SERVICE CARD

Microsoft LAN Manager

BY JOE SALEMI With *Microsoft LAN Manager* 2.1, Microsoft finally has a real alternative to Novell's *NetWare*. Fast and versatile, *LAN Manager* works across multiple protocols, and its compatibility with *IBM OS/2 LAN Server* gives it connections to the mainframe environment. Tight integration with Microsoft Windows makes using *LAN Manager* a breeze.

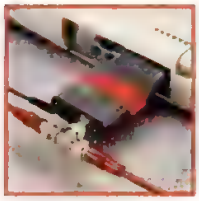
Microsoft also added fault-tolerance and management features, and it enhanced the printing facilities. At $1,995, the base *LAN Manager* package supports ten users and includes a copy of Microsoft's OS/2 1.3, enhanced for server use.

The drawbacks to *LAN Manager* 2.1

SUITABILITY TO TASK	Microsoft LAN Manager
Mac-to-server connectivity	● ● ● ●
DOS-to-Unix connections	N/A
OS/2 connectivity	● ● ● ●
UPS	● ● ● ●
Administration	● ● ● ●
Security	● ● ● ●

Xircom Pocket LAN Adapters:

The Universal LAN Connection for Laptops



What do all laptop and notebook PCs have in common? They can conveniently connect to a galaxy of LANs with award-winning Xircom Pocket LAN Adapters, the universal solution for laptop-to-LAN connectivity.

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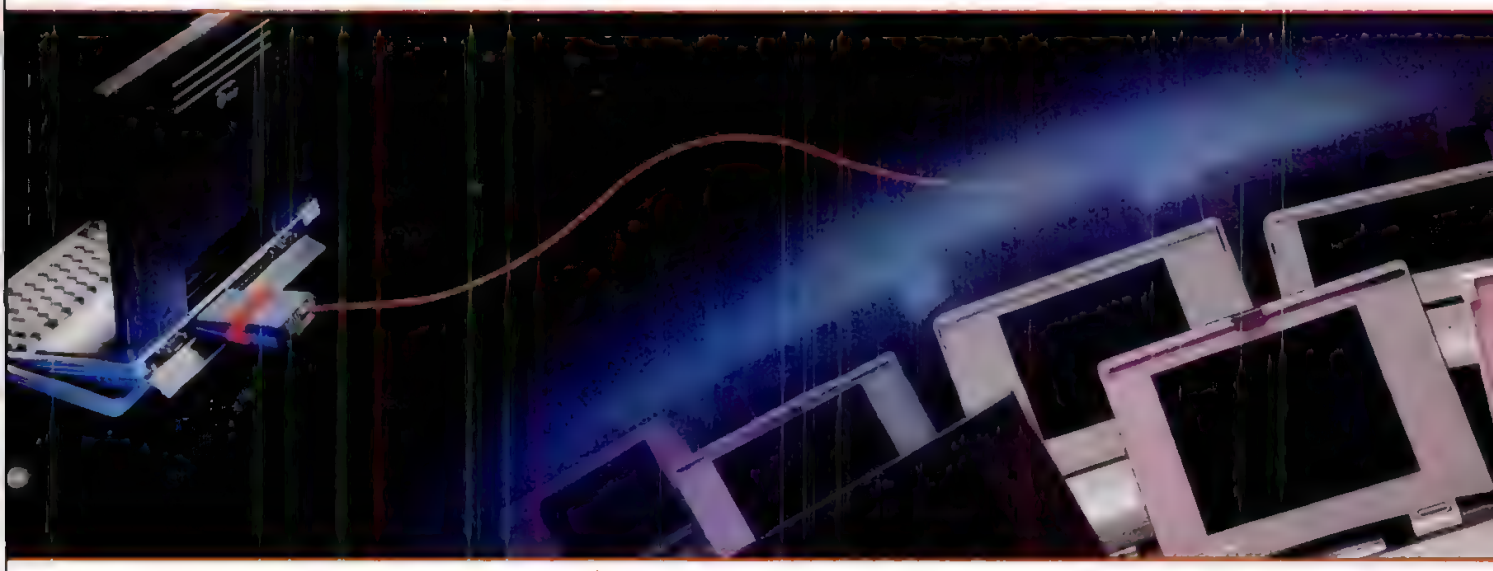

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boil down to two areas. Weak customer support can make it difficult to troubleshoot problems. More important is the question of OS/2's viability as a platform for future *LAN Manager* growth.

THE ARCHITECTURE

As in earlier versions, *LAN Manager*'s unique architecture provides one of its strongest features: versatility. *LAN Manager* is the only one of the network operating systems reviewed here that can save network managers lots of headaches by connecting the client and the server with any number of a wide range of transport protocols, including *LAN Manager*'s NetBEUI (NetBIOS Extended User Interface) and TCP/IP (see the diagram "Microsoft LAN Manager Architecture").

Two factors provide *LAN Manager* with its flexibility. Above the transport protocol lies the NetBIOS application programming interface (API). NetBIOS receives Server Message Block (SMB) packets and delivers them across the network. With a common API, applications are shielded from the nuances of these different transport protocols.

Below the different transport protocols lie NDIS (Network Driver Interface Specification) and 3Com's DPA (Demand Protocol Architecture), which enable *LAN Manager* to run multiple protocol stacks on a single client. The combination of DPA and NDIS enables users to load and unload alternate protocols, such as Novell's IPX, 3Com's XNS, or the OSI transport layer, TP4.

There are some holes in *LAN Manager*'s internetworking strategy. Probably the program's most glaring problem is the inability to route NetBIOS over *LAN Manager*'s native protocol, NetBEUI. Microsoft compensates for this by offering NetBIOS over TCP/IP, which provides the necessary network layer infor-

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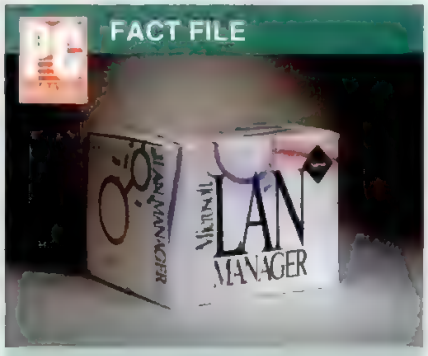

***Microsoft LAN Manager*, Version 2.1**
Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399, 206-882-8080.
List Price: 10-user base version, $1,995, additional 10-user pack, $995; unlimited-user add-on pack, $5,495.
Requires: Server: 386-based PC or better, 5MB RAM, 30MB hard disk, NDIS-compatible network card. 8MB RAM recommended. Client: 512K RAM, 20MB hard disk, NDIS-compatible network card. If running Microsoft Windows, 640K conventional RAM and 256K extended memory recommended.
In Short: *Microsoft LAN Manager* 2.1's improved management features, fault tolerance, print facilities, and performance make it a serious contender. Many third-party client/server applications are available for *LAN Manager*, and *LAN Manager* supports AppleTalk, TCP/IP, and a widely compatible server version of OS/2. Despite its multiple-protocol support, however, *LAN Manager*'s native internetworking capabilities are limited. Users should also be concerned with the uncertainty over OS/2's future.

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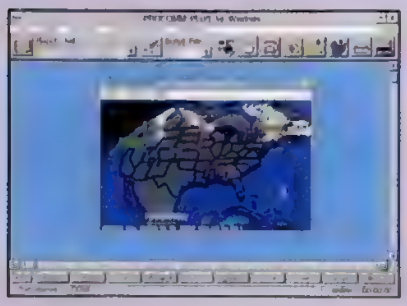
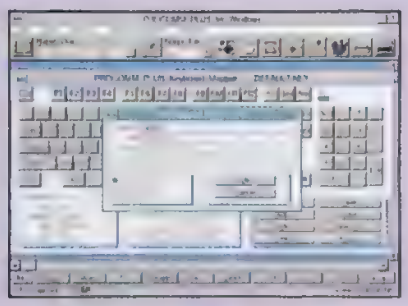
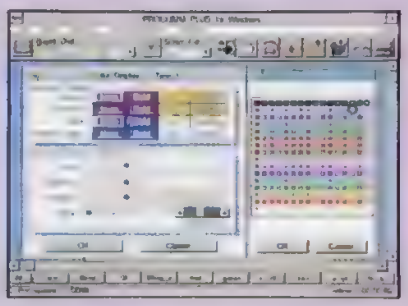






DATASTORM

DATASTORM TECHNOLOGIES, INC.

P.O. Box 1471 • Columbia, MO 65205 • 314.443.3282

CIRCLE 083 ON READER SERVICE CARD

mation interpreted by the routers.

Since most Unix hosts do not understand NetBIOS, however, *LAN Manager* clients can only access other *LAN Manager* servers. Microsoft hopes to correct this problem by the press time, with a set of TCP/IP utilities that will allow DOS or OS/2 clients to access Unix hosts. The utilities will cost $195 per client.

ENHANCED PERFORMANCE

Microsoft has boosted *LAN Manager*'s performance by refining the NetBEUI protocol and enhancing the version of HPFS386 (High-Performance File System) in *LAN Manager* 2.0.

One of the major bottlenecks in earlier versions of *LAN Manager* was the lack of selectors allocated to NetBEUI. A selector is a prioritizing mechanism that gives access to memory. With a selector, OS/2 guarantees NetBEUI up to 64K of RAM, thus enabling NetBEUI to cache more network activity without performing extra operations, such as moving data around memory or to disk.

In earlier versions of *LAN Manager*, Microsoft was reluctant to allocate more selectors to NetBEUI because the company thought it might degrade the performance of other applications on the server. After extensive testing and field research, Microsoft says that server-based applications should continue to function normally without degradation, but the company does concede that it is possible though unlikely for an application's performance to degrade.

One of the biggest enhancements made to **LAN Manager** *is its ease of installation.*

The process of allocating selectors is also made more efficient in *LAN Manager* 2.1. *LAN Manager* now assigns the number of selectors dynamically, based on the number of simultaneous sessions established in the LANMAN.INI file in the server. In previous versions of *LAN Manager*, OS/2 allocated a constant number of selectors to the network operating system.

Finally, Microsoft has corrected two problems that limited HPFS386. The first problem involved how HPFS was implemented. Earlier versions of *LAN Manager* created a piece of code, called a *throttle*, to arbitrate access to the CPU and prevent HPFS from monopolizing the processor. The code failed to work properly and would actually interrupt HPFS, hampering *LAN Manager* activity.

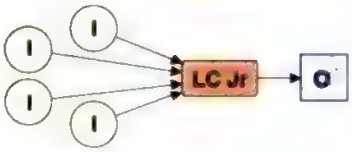
Microsoft made the second fix to the cache. Under earlier versions of *LAN Manager*, every write from the cache to the hard disk was preceded by a read of the data on the hard disk to verify that the cached data was accurate. That took time. *LAN Manager* 2.1 uses special bits, called *valid bits*, in cache to indicate if the cached data is up to date, thus enabling *LAN Manager* 2.1 to avoid the extra read.

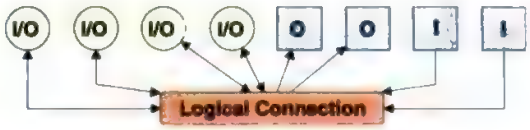
RELIABILITY AND MORE

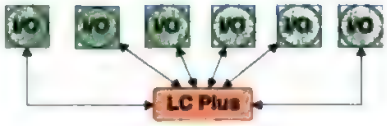
Microsoft has also improved fault tolerance to provide *hard disk mirroring* (two

Printer Sharing

= PARALLEL DEVICE = SERIAL DEVICE = PARALLEL OR SERIAL DEVICE I = INPUT FROM PC O = OUTPUT TO PERIPHERAL

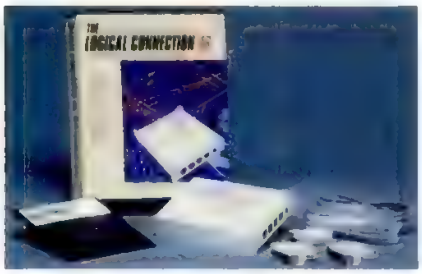






LC Jr.-256Kb $239

Serially connect up to four PCs to the **Logical Connection Jr.** at speeds up to 115,200 bps. It will automatically convert the data for easy sharing of one parallel printer.



LC-512Kb $495

The **Logical Connection** has eight ports: four bi-directional serial ports which can be set as input or output, two parallel inputs and two parallel outputs.

LC Plus-512Kb $695

All six ports of the **Logical Connection Plus** are automatically configured as parallel or serial, and input or output. Versatility and high speed are key features.

- **UL Listed Power Supplies**
- **FCC Class B Certification (LCJr. - A)**
- **Fast Data Input and Throughput**
- **Socketed DRAM Upgrades to 1Mb**
- **Largest Selling PSDs in the USA**

Logical Connections allow several users to easily share expensive printers and other resources. Choose the peripheral that you need with a pop-up menu or ASCII string.

Multiple users can send data simultaneously since Logical Connections with memory will buffer and queue jobs on a first-in-first-out basis. A 256Kb buffer will hold up to 100 pages of text or about 5 - 10 pages of graphics data.

If your company has a LAN, use Logical Connections for local printer sharing in smaller workgroups, rather than printing centrally through the LAN. Local printing is more convenient and more secure!

LC -41PAS $100

Smart switch to automatically connect up to 4 parallel inputs to 1 parallel output.

SPPS $60

Serial/Parallel or Parallel/Serial converter, no power supply required.

Logical Connection, Inc.
4660 Portland Road NE #108, Salem, OR 97305
FAX: (503) 390-9372
Tech. Support: (503) 390-9375

LOGICAL CONNECTION 800-238-9415 US & Can.

Laptop Memory

Macintosh Powerbook 100 (Dealer must install)

Memory Module	EPB-2000	2 Mb	$275
Memory Module	EPB-4000	4 Mb	$500

Macintosh Powerbook 140/170 (Dealer must install)

Memory Module	EPC-4000	4 Mb	$500
Memory Module	EPC-6000	6 Mb	$750

Toshiba Laptop Models: (User may install)

1000SE/XE/LE, 2000, 2000SX (All Sizes); 2000SXE, 2200SX (exclude 1Mb)

Memory Card	RCT-1000	1 Mb	$150
Memory Card	RCT-2000	2 Mb	$200
Memory Card	RCT-4000	4 Mb	$400
Memory Card	RCT-8000	8 Mb	$700

PC-MCIA 2.0 / JEIDA SRAM (User may install)

For Laptops conforming to this new universal spec.

Memory Card	RJB-0512	512 Kb	$195
Memory Card	RJB-1000	1 Mb	$450
Memory Card	RJB-2000	2 Mb	$750

CIRCLE 131 ON READER SERVICE CARD

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4 PPM

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In November 1991, Okidata's new OL830 Adobe® PostScript® printer won the same coveted award. Once again, the editors praised our printer's overall performance and value. They found it to be the fastest of *all* 8-ppm printers tested in PCL (HP emulation) graphics mode. And considering its record-setting low price, they rated it "the best inexpensive PCL/PostScript printer available".*

leads to another.

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CIRCLE 235 ON READER SERVICE CARD

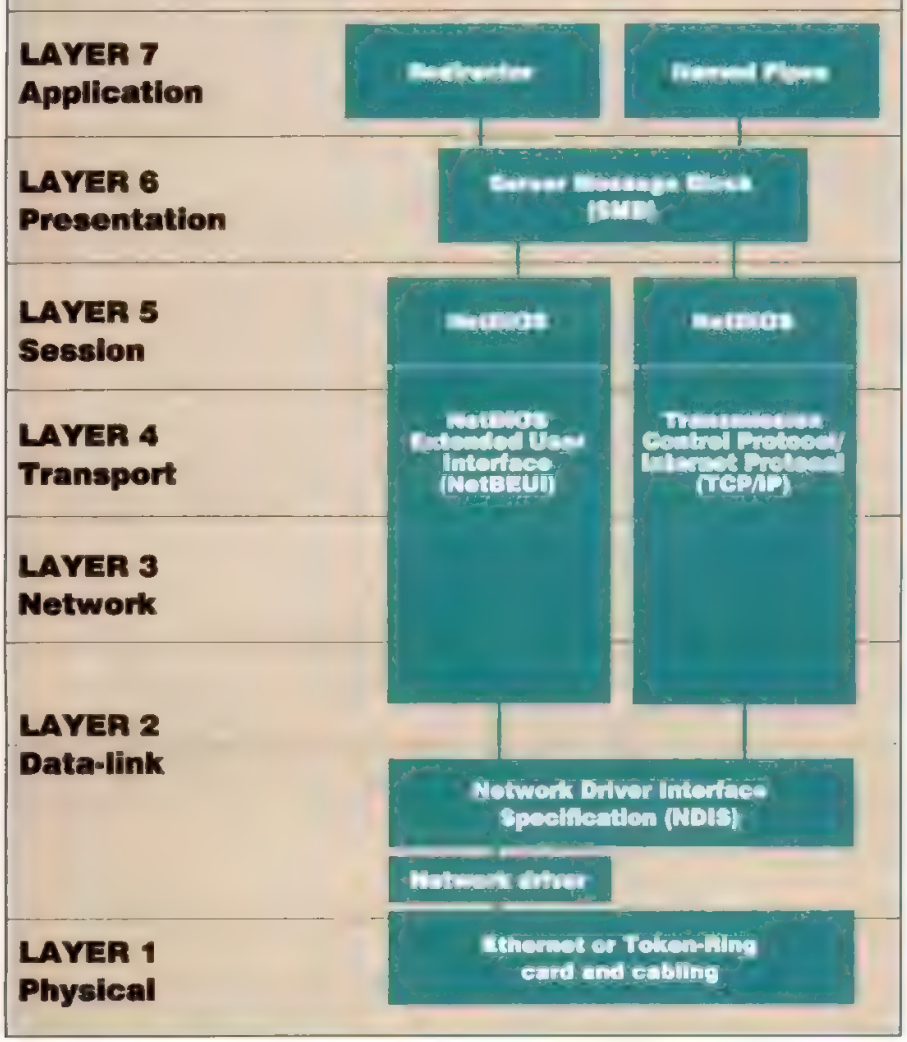
hard disks on the same controller replicating each other) or *duplexing* (two hard disks on separate controllers). Previously, *LAN Manager* provided a hot-fix capability, which checked for bad sectors but provided no mirroring or redundancy. Under the current network operating system, you are able to send error and status information to a NetView management host or use SNMP to give the information to a management system on a TCP/IP host.

One of the biggest enhancements made to *LAN Manager* is its ease of installation; it took between 45 minutes to just over an hour to bring up the server. The exact length of time may vary depending on the hard disk size, since the disk format takes anywhere from 5 to 10 minutes per 100MB of disk space.

Installing the original version of the *LAN Manager* software required editing the LANMAN.INI file manually to tune the server. In the new version, a feature called *autotuning* automatically calibrates the network operating system to suit the needs of the specific LAN. *LAN Manager* automatically sets parameters within LANMAN.INI, such as the number of messages that can be simultaneously processed, the amount of disk cache, and the size of a message block.

MICROSOFT LAN MANAGER ARCHITECTURE

Thanks to NetBIOS on top and NDIS on the bottom, *Microsoft LAN Manager* enables clients to speak multiple protocols to the server without necessitating changes in the applications.



Installation is not the only easier feature. Accessing the network is a cinch thanks to *LAN Manager*'s tight integration with Windows. Users can log on and off the network, access shared resources, and manage the network all from within Windows. With *NetWare*, you have to exit Windows to perform some of these operations.

LAN Manager makes network administration easy. The full-screen NETADMIN utility handles all of the administration chores. You can run it either from the server or from an OS/2 client station; administration from DOS clients is limited to a command line interface. From one location, you can manage any server or multiple servers on the network domain and view and clear the server's audit trail and message and error logs.

PRINTING FEATURES

LAN Manager's printing facility provides various important features, including a special print processor for formatting the print job prior to spooling it to the printer. This is particularly handy with a PostScript printer, as it reformats ASCII data into PostScript format. For most other print jobs, the processor does nothing more than make sure that the document is in the proper format for the printer.

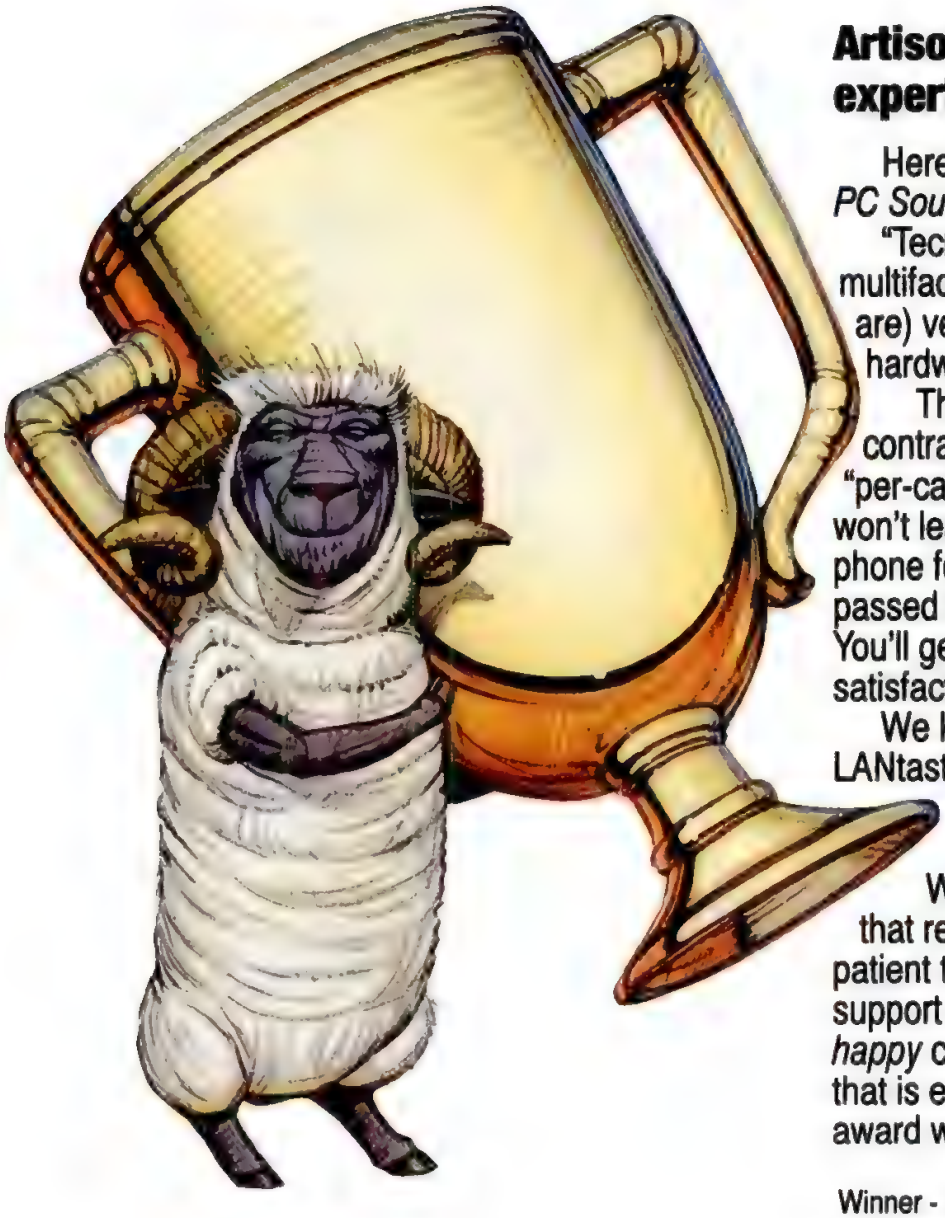
Despite improvements, Microsoft's uncertain commitment to the OS/2 server platform could hamper LAN Manager*'s success.*

Users can also check on the status of their print jobs, though the status report is limited to whether the job is printing, waiting, or on hold. *LAN Manager* also allows select users to change the priority of their print jobs, delete jobs from the print queue, and receive pop-up messages when the print job finishes spooling.

DELAYED SUPPORT

Despite these improvements, two big problems could hamper *LAN Manager*'s

BEST SUPPORTING PERFORMANCE



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CIRCLE 254 ON READER SERVICE CARD

success. The first is the uncertain future of Microsoft's commitment to the OS/2 server platform; Microsoft has already announced plans to move *LAN Manager* to Windows NT, which will make Windows NT Microsoft's development platform of choice.

The second problem is support. Now that Microsoft has folded its *LAN Manager* staff into the Corporate Network Systems Business Unit division, the network of authorized specialists has become the primary support channel.

Support is also available directly from Microsoft's regional sales offices, but it proved disappointing: When OS/2 did not recognize the hard disk array attached to our Compaq Systempro 486/33, it took Microsoft's technical support 24 hours to return our initial call (we finally got OS/2 to work on a different server).

It also took Microsoft three days to tell us that our Proteon 1390 Token-Ring adapters would not work with *LAN Manager*. Microsoft suggested using the Compaq EISA Token-Ring card as a replacement in the file server. Proteon is in the process of certifying its adapters with Microsoft.

The server requires 5MB of RAM, although Microsoft recommends 8MB to 16MB of RAM. The company certifies that the version of OS/2 included with *LAN Manager* is compatible with over 250 systems. This solves one of the biggest problems with earlier *LAN Manager* releases: finding an OS/2 for your particular server. *LAN Manager* does not support server multiprocessing.

Pricing for *LAN Manager* varies, depending on the reseller, but add-on packs for ten users generally carry a list price of $995. An unlimited user add-on pack is available for $5,495, considerably less than *NetWare*'s $12,495, 250-user version. Upgrades from 2.0 to 2.1 cost $495 per server, and a General Upgrade LAN Program (G.U.L.P.) designed for users of original equipment manufactured versions of *LAN Manager*, such as 3Com's *3+Open*, is available for $1,495.

SUMMARY OF FEATURES

Products listed in alphabetical order

Microsoft LAN Manager, NetWare, and VINES provide many of the same security, administrative, auditing, and archival services. All of these products offer multiple levels of passwords and access rights. They also track user log-ons. As for reliability features, LAN Manager, NetWare, and VINES can all back up the servers' disks and selected directories and files. Here is how the products stack up. Additional functionality is available from third-party vendors.

■—Yes ❑—No

	Microsoft LAN Manager 2.1	NetWare 3.11	VINES 4.11
List price	$7,490	$6,995	$7,495
Number of users supported	Unlimited	100	Unlimited
CONFIGURATIONS			
Maximum number of simultaneous users	1,000	100	Unlimited
Maximum number of server volumes	500	64	12
Maximum number of concurrently open files	8,000	100,000	200,000
Drivers supported:			
The Clarkson Packet Driver Collection	❑	❑	❑
NDIS	■	■	■
ODI	❑	■	❑
DIRECTORY SERVICES			
Distributed database	■	❑	■
Global naming abilities	■	❑	■
Physical names mapped to logical names	■	❑	■
X.500-compliant naming conventions	❑	❑	■
Directory of resources	■	■	■
Synchronized changes to directory	■	❑	■
Directory of users available across enterprise-wide network	■	❑	■
SECURITY			
Passwords can be assigned to resources	■	❑	■
Read/write/create/delete/execute	■	N/A	■
Blocks simultaneous log-ons	❑	■	■
ADMINISTRATIVE UTILITIES			
Can create systemwide log-on script	■	❑	■
Allows hot fixes	■	■	❑
Automatically updates workstation shell at log-on	❑	❑	■
SERVER-TO-SERVER CONNECTIVITY			
Supports TCP/IP	■	■	$3,995
Encapsulation or native mode	Native	Native	Both
Supports OSI	❑	❑	■
Encapsulation or native mode	N/A	N/A	Native
Supports SNA gateway	❑	$2,995	$1,495
Administrator can perform remote boot	■	■	■
SERVER BRIDGING AND REMOTE ACCESS			
Maximum number of adapters per server	4	16	4
HDLC/synchronous bridge	❑	■	■
T1 bridge/router	❑	❑	❑
X.25 point-to-point bridge/router	❑	❑	❑
X.25 multiport packet-switched router	❑	❑	❑

N/A—Not applicable: The product does not have this feature.

CONTINUES

NetWare

BY M. KEITH THOMPSON Once optimized for small workgroups, Novell's *NetWare* has since grown into a robust enterprise-wide network operating system. The current version features good

IF THESE MAKE A GOOD IMPRESSION, WAIT TILL YOU MEET THE REST OF THE FAMILY.

Dell 325SX 25 MHz i386SX System.
System includes:

- 2 MB RAM
- 50 MB hard drive
- VGA Color Monitor
- 1024 x 768 integrated video support
- Expandable to 8 MB RAM
- 3 16-bit expansion slots
- 1 floppy drive

Dell 486P/33 33 MHz i486 System
System includes:

- 4 MB RAM
- 120 MB Hard Drive
- UltraScan 14C Monitor
- Upgradeable Processor board
- 1024 x 768 integrated video support
- RAM expansion to 64 MB
- 1 floppy drive

Dell 420DE 20 MHz i486 System
System includes:

- 4 MB RAM
- 120 MB Hard Drive
- VGA Color Plus Monitor
- Upgradeable processor board
- 1024 x 768 integrated video support
- RAM expansion to 96 MB
- 1 floppy drive

Dell 433SE 33 MHz i486 System
System includes:

- 4 MB RAM
- 230 MB Hard Drive
- UltraScan 14C Monitor
- Upgradeable processor design
- 128 KB external cache
- RAM expansion to 128 MB
- 1 floppy drive

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Approx. # of employees in company: _____
Installed # of PCs in your company: _____
Home Phone: (_____) _____
Business Phone: (_____) _____
Fax Number: (_____) _____

1. Which products are you most interested in, and how many do you plan to purchase in the next 12 months?

Timeframe	i486	i486SX	i386	i386SX	Notebook	Other
Less than 1 month						
1-3 months						
3-6 months						
6-12 months						
More than 12 months						

2. If you resell, please identify your primary customers:
☐ Education ☐ General Business ☐ Government ☐ Medical
3. By which method do you acquire PCs?
☐ Mfg rep calls on me directly ☐ Local retailer
☐ VAR/Integrator ☐ Mail order/direct
4. From whom do you currently purchase PCs? _____
5. Are you interested in leasing? ( ) Yes ( ) No

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Installed # of PCs in your company: _____
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1. Which products are you most interested in, and how many do you plan to purchase in the next 12 months?

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More than 12 months						

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☐ Education ☐ General Business ☐ Government ☐ Medical
3. By which method do you acquire PCs?
☐ Mfg rep calls on me directly ☐ Local retailer
☐ VAR/Integrator ☐ Mail order/direct
4. From whom do you currently purchase PCs? _____
5. Are you interested in leasing? ( ) Yes ( ) No

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performance, low hardware and memory requirements, flexible remote print server support, and multiple-protocol capability. But an inconvenient upgrade strategy, weak network management, and high prices may deter some users from adopting this product.

NetWare 3.11 is the flagship product of a suite of network operating systems offered by Novell. Currently, 3.11 ranges from $1,095 for a 5-user license to $12,495 for a 250-user license. *NetWare* uses 65K on the client PC. You can load the program into upper memory and leave less than 20K behind in main memory.

Unlike *Microsoft LAN Manager* or *VINES*, an entry-level *NetWare* server can run on a 386SX CPU and 4MB of RAM. But most networks will require a more powerful configuration. A 10-node *NetWare* network, for example, will typically require a 386-based PC with at least 6MB of RAM.

At the heart of *NetWare* lies a modular architecture that enables users to plug various software modules into the server to enhance the functionality of the base operating system (see the diagram "NetWare Architecture"). Dubbed *NetWare* Loadable Modules (NLMs), these products enable the server to change to meet various needs.

At the heart of* NetWare *lies a modular architecture that lets users plug software modules into the server to enhance the base operating system.

These NLMs can speak to various transport protocols, including TCP/IP, AppleTalk, OSI's TP4, and *NetWare*'s native IPX/SPX. As with *LAN Manager*, *NetWare*'s ability to run multiple protocols lies in a driver specification, in this case ODI (Open Data-link Interface). Consequently, a single *NetWare* server can seamlessly integrate DOS, OS/2, Mac, and Unix clients on a network.

ODI also enables a single client to attach to multiple networks. Through extra software, a DOS client can simultaneously attach to a *NetWare* server and a Unix host.

The internetworking capabilities of *NetWare* 3.11 extend beyond the ability to run multiple protocols. *NetWare* now connects servers across a backbone through TCP/IP tunneling. In the future, Novell plans to add full *NetWare* routing.

Novell also offers *NetWare NFS*, a $4,995 option that enables a server to offer file and print services to Unix clients. *NetWare NFS* does not let *NetWare* clients access a Unix file system, however. That requires a separate product, *LAN Workplace*, running on the client. If Novell enabled a *NetWare* server to mount a Unix file system, however, *NetWare* clients could access a Unix file system without the additional cost and complexity of *LAN Workplace*.

There may be at least one drawback to this approach, though. Forcing the *NetWare* server to map between TCP/IP and SPX/IPX would place an additional strain on the server, and by not accessing the Unix host directly, users would see some performance degradation.

Novell also runs *NetWare* on a multitude of other platforms, including *NetWare for VMS* and *NetWare for Unix*. Novell plans to port *NetWare* to OS/2.

PERFORMANCE TO BEAT

NetWare beat its competitors on our tests with 16- and 24-client loads, but as it approached 32 clients, we reached the maximum amount of RAM that *NetWare* could access in our Systempro, and performance began to decline. *VINES* was faster in server-to-server tests.

On the printing side, *NetWare* performs well. *NetWare* supports a total of 16 printers per server. *NetWare* allows users to start, stop, and delete print jobs from queues. Its PCONSOLE utility reports the size of the file being printed, the file's owner, and the job's status.

If you do not want to use *NetWare*'s print utilities, you can choose from many third-party products, including Intel's *LANSpool*, Brightwork Development's

SUMMARY OF FEATURES

Products listed in alphabetical order

■—Yes ❑—No

	Microsoft LAN Manager 2.1	NetWare 3.11	VINES 4.11
NETWORK PRINTING			
Automatic clearing	■	■	■
Deferred printing	■	■	■
Administrator/user can view queue	■/■	■/■	■/■
Administrator/user can reorder queue	■/❑	■/❑	■/❑
Administrator/user can delete any job from queue	■/❑	■/❑	■/❑
Multiple queues per printer	■	■	■
Multiple printers per queue	■	■	■
Print preprocessor	■	❑	■
FAULT TOLERANCE			
Split seeks	❑	■	■
Read verifications	■	■	■
Hard disk mirroring/duplexing	■/■	■/■	■/❑
Split seeks on mirrored drives	❑	■	■
Sector recovery on mirrored drives	■	■	■
Server duplexing	❑	❑	❑
FILE SYSTEMS SUPPORTED			
OSI/FTAM	❑/❑	❑/❑	❑/❑
Unix/NFS	❑/❑	$12,995/$4,995	$7,495/❑
OS/2 HPFS	■	■	■
MISCELLANEOUS FUNCTIONS			
Salvages deleted files	❑	■	❑
Purges deleted files	■	■	■

ENDS

SUITABILITY TO TASK

	NetWare
Mac-to-server connectivity	● ● ● ●
DOS-to-Unix connections	● ● ● ●
OS/2 connectivity	● ● ● ●
UPS	● ● ● ○
Administration	● ● ● ●
Security	● ● ● ○

BENCHMARK TESTS

A network operating system's performance depends mainly on the amount of memory available, particularly for its cache, and the quality of drivers used to connect with the network interface cards.

WHAT THE NUMBERS MEAN

All products showed a loss in performance by the time the load was increased to 32 workstations. As expected, each network operating system's throughput correlated with the amount of network bandwidth used.

The two most important factors for achieving the best performance are the amount of memory the network can use as a cache and the quality of the driver for the adapter card. For a base platform, we used a generic driver with our testing; better performance might be achieved with a driver optimized for a particular network operating system.

Since our test file size was 1MB, the network operating systems began to run out of available memory as the number of stations increased. The exact point where each network operating system ran out of memory depended on the environment. Although the file server was equipped with 32MB of RAM, only *NetWare* 3.11 could address that amount. The performance of *Microsoft LAN Manager* 2.1 and *VINES* 4.11, which could address only 16MB of RAM, began to decline as we approached 16 workstations. But *NetWare* was able to maintain throughput until it reached its limit, between 24 and 32 stations.

Within the 8-station range, *LAN Manager* exhibited far better performance than *NetWare* or *VINES*. The reason for this superior performance was NetBEUI's use of an effective sliding-window algorithm. With a sliding-window algorithm, a client is able to receive a large number of frames before sending back an acknowledgement. *NetWare* does not use a sliding-window protocol. *VINES*, which does use a sliding-window protocol, is slower than *LAN Manager* because of operating system overhead.

LAN Manager also transfers more data in a single frame than *NetWare* or *VINES*. *LAN Manager* uses a 2K block, as opposed to *NetWare*'s 512-byte block and *VINES*' 1,500-byte block (in our default configuration). By using a larger block, NetBEUI (in *LAN Manager*) accomplished the 10K read in 5 requests, instead of the 20 requests needed by IPX (in *NetWare*) or the 6 requests needed by *VINES*.

Rumor says that Novell will employ Burst Mode IPX in its next version of *NetWare*, increasing the maximum IPX block size. Banyan Systems has not said whether it will increase the block size of *VINES*.

The combination of the sliding-window protocol and the larger block size was the key reason *VINES* more than doubled *NetWare*'s performance on the internal routing test. *LAN Manager* was not tested, since it does not support internal routing.

HOW WE TESTED

As networks evolve from supporting small workgroups to servicing large corporations, the amount of traffic on these LANs also changes. To keep pace with this trend, *PC Magazine* and its sister organization, ZD Labs, have revised their current benchmark tests. The result is the new ZD Labs NetBench.

The ZD Labs NetBench consists of three tests. In this review, we used one of them, the Hard Disk Access Load test, to push each network operating system's performance limits, both from client to server and from server to server. The Hard Disk Access Load test simulates typical client/server activity on a given network and measures the total throughput of the network operating system.

We used the Hard Disk Access Load test to measure two different performance issues. First, we looked at what happens to each product's client-to-server performance as workstations are added. We measured the throughput in different configurations and correlated our findings with measurements of how much of the potential bandwidth was used (as indicated by a Bytex analyzer). We also tested the efficiency of each product's internal routing, where applicable.

CLIENT AND SERVER CONFIGURATIONS

For the client-to-server test, we set up a separate network with each of our three operating systems. In each case we installed four 16-megabit Compaq bus-mastering Token-Ring adapters in the server, which was a single-processor Compaq Systempro with 32MB of RAM. Each adapter handled a segment of the network.

The clients were attached to each Token-Ring adapter via a Multistation Access Unit (MAU). We used a total of eight clients per network segment. All the clients were 386SX-based Compaq Deskpro 386n's, each with 5MB of RAM and a Proteon 1390 Token-Ring adapter. We used Proteon's high-speed driver, the Proteon p139x RapiDriver 1.05, to connect the network operating system and the adapter.

We ran the Hard Disk Access Load test with 1 client and then retested with larger numbers of workstations: 8 PCs (2 per network segment), 16 PCs (4 per segment), 24 PCs (6 per segment), and 32 PCs (8 per segment).

In order for *NetWare* to operate across all four boards simultaneously, we also increased the minimum and maximum receive buffers to their fullest capacity and the maximum received packet size to its largest value. *LAN Manager* and *VINES* were able to support four network adapters without modification.

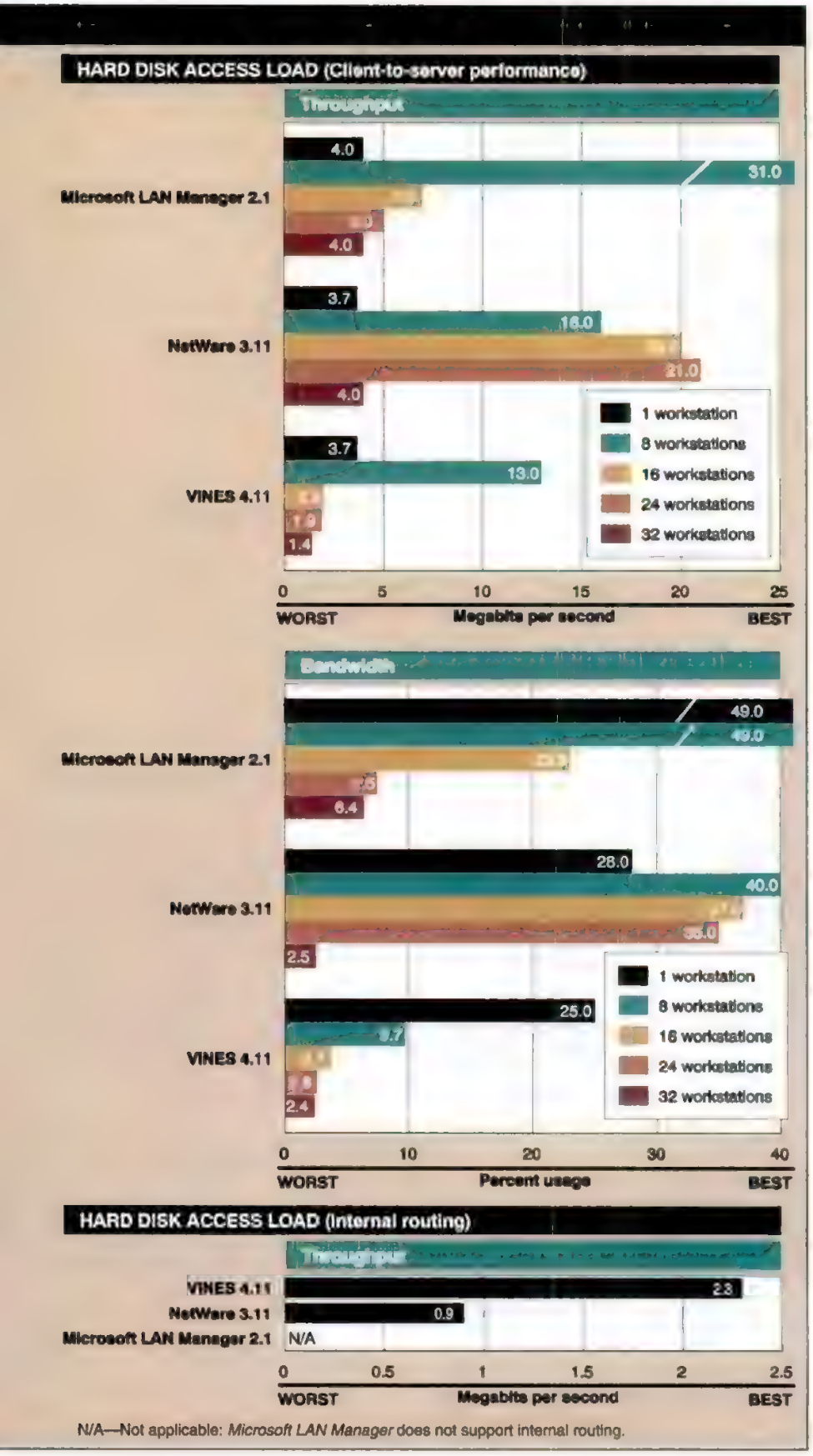
INTERNAL ROUTING

To test the file servers' routing capabilities (what Novell formerly called *bridging*), we attached two servers together: The routing server was a Compaq Deskpro with 8MB of RAM and two NE3200 adapters installed, while the file server was a Compaq Systempro with 32MB of RAM and a NE3200 Ethernet adapter. Connected to the file server was a client PC—a Compaq 386/25e with 4MB of RAM and a NE2000 adapter card installed.

We ran our Hard Disk Access Load test from the client PC to the file server across the internal router located on the routing server.

The **Hard Disk Access Load** test simulates the typical usage of application software on a LAN. The test examines how well each network operating system can handle continuous requests of three reads and one write from the client to the server. Initially, a 1MB file is generated on the file server for each client. Each station randomly reads a 10K block from that file and then randomly writes a 10K block back to that file.

To measure internal routing throughput, we insert a routing server between the client and the file server and then run the Hard Disk Access Load test on the file server.



N/A—Not applicable: *Microsoft LAN Manager* does not support internal routing.

PS-Print, and Insight Development Corp.'s *Mosaic Print Server*.

MULTISERVER ENVIRONMENT

In moving *NetWare* from the workgroup to the enterprise, Novell has sought to correct a long-standing problem: *NetWare*'s lack of network management. With Version 3.11, Novell has built network management functions right into the network operating system. *NetWare* 3.11 can pass data up to IBM's NetView and, thanks to an SNMP agent, to SNMP management stations such as Novell's new *NetWare* Management System (NMS). NMS provides an open and extensible environment for managing the *NetWare* environment, as well as hubs, routers, and WAN links. NMS should be shipping by the time you read this article.

One of the real benefits of NMS is its tight integration into the server platform. When running over the Compaq Systempro, for example, NMS can accept alerts passed up by Systempro hardware. It is not clear, however, whether other hardware platforms will be able to use the full functionality of NMS.

Novell's *NetWare* Name Service makes managing multiple servers simpler. Sys-

***NetWare*, Version 3.11**
Novell Inc., 122 E. 1700 South, Provo, UT 84606; 800-453-1267, 801-429-7900
List Price: 5 users, $1,095; 10 users, $2,495; 20 users, $3,495; 50 users, $4,995; 100 users, $6,995; 250 users, $12,495. SNA gateway support, $2,995; Unix support, $12,995; NFS support, $4,995
Requires: Server: 386-based PC or better, 4MB RAM, 50MB disk space, *NetWare*-compatible network card. Client: 80K RAM.
In Short: Despite its higher price, *NetWare* remains a good, safe choice for medium to large workgroups. It offers a strong market presence, excellent third-party support, quick client-to-server communication, and efficient use of server resources. But *NetWare*'s weaker server-to-server performance and limited multiserver management might make *LAN Manager* or *VINES* better suited for building and managing large, enterprise-wide networks.

CIRCLE 483 ON READER SERVICE CARD

tem administrators group servers into domains. Each domain includes a name server to keep track of user passwords and network privileges. As the system administrator makes changes to the user's data, the name server copies the user database to the other servers on the domain.

Despite these improvements, *NetWare* lacks some critical features that limit its effectiveness in the multiserver environment. Unlike *LAN Manager* and *VINES*, *NetWare* does not let you set user privileges on one server for the entire network. Novell expects to fix this by adding an X.500 directory service in its next release.

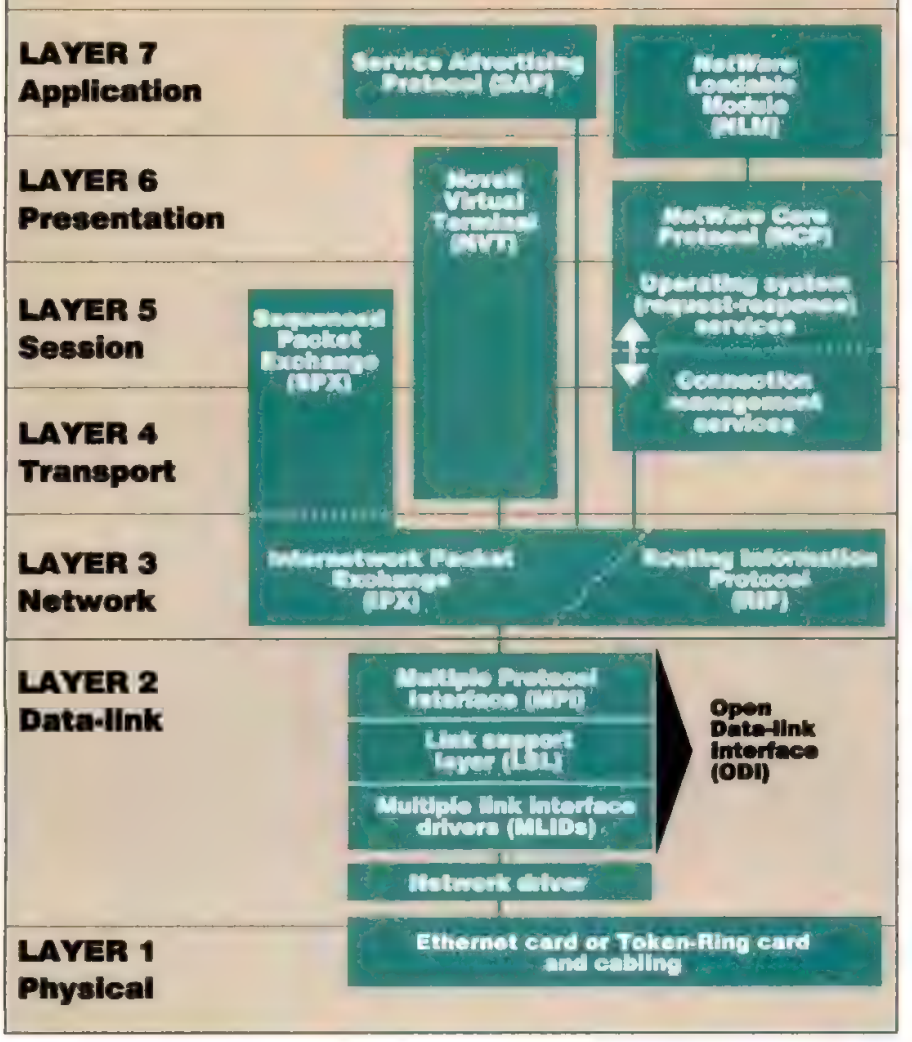
As for fault tolerance, Novell currently offers disk mirroring and disk duplexing. The next major enhancement to *NetWare*, *Novell SFT III*, will create mirrored servers, allowing a backup server to take over if the primary server goes down.

Novell offers a set of network tools for both Microsoft Windows and OS/2, allowing you to log on to servers, administer the network, send messages, and edit scripts. Novell plans to put a graphical user interface on all of its character-based utilities. These products will be available to users enrolled in the *NetWare* Maintenance Program.

Installing *NetWare* 3.11 is nowhere near as difficult as installing the original 2.*x* versions. If your server includes the necessary hardware, installation takes about 30 minutes. Although it is not completely intuitive or menu driven, you can easily follow the instructions in the manual. The package includes drivers for most network cards.

NETWARE ARCHITECTURE

***NetWare* 3.11's architecture enables you to plug software modules, called *NetWare* Loadable Modules (NLMs), into the server to enhance the server's functionality.**



STILL TOO PRICEY

Although Novell recently added smaller configurations of *NetWare* to its pricing strategy, *NetWare* 3.11 consistently ranks at the top of the price list. In a move uncommon in the PC marketplace, Novell raised the price of the 250-user version of *NetWare* when it moved from 3.0 to 3.1. Originally, *NetWare* 3.0 cost $7,995 and supported up to 250 users. When 3.1 arrived, the price jumped to $12,995, roughly a 60 percent increase.

NetWare users can choose from many support services, including Novell's forum on CompuServe, Novell's expensive new *NetWare* Maintenance Program, and contracted telephone support. Many third-party companies also offer top-notch *NetWare* service and support.

Coupled with a vast array of third-party add-on products, *NetWare* offers the most complete network environment currently on the market. *NetWare*'s real weakness, its lack of sophisticated network management, should disappear in the near future with the addition of the *NetWare* Management System.

Over the last few years Novell's technical edge in the network operating system market has dwindled, but its strong support from third-party developers compensates for many of its weaknesses. Although *NetWare* 3.11 lacks many of the global networking features found in *LAN Manager* or *VINES*, the new internetworking hooks and SNMP management system, coupled with a strong market presence, still make *NetWare* a good buy.

VINES

BY FRANK J. DERFLER, JR. When building a large multiserver network is your main concern, Banyan Systems' *VINES (VIrtual NEtworking System)* remains the leader. It simplifies attaching to and using resources on any server, without customized batch files and log-on scripts. *VINES* also offers excellent security, interoperability, reliability, and top-notch CPU performance with its symmet-

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Ease of learning	Very Good	Very Good
Ease of use	Very Good	Good
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Support		
Support policies	Good	Satisfactory
Technical support	Satisfactory	Satisfactory
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Final Scores	7.6	7.1

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PC Magazine, November 12, 1991

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"...an excellent value." *InfoWorld, November 4, 1991*

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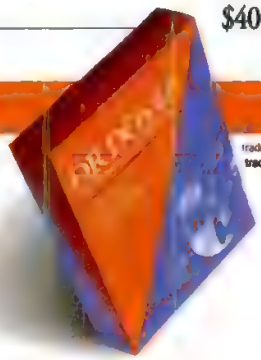

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NOVELL

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ric multiprocessing. *VINES* ranges from a five-user version at $1,295 per server to an unlimited version at $7,495 per server.

VINES runs best in a server equipped with 16MB of RAM or more. For more horsepower, you can try the version known as *VINES Symmetric Multiprocessing (SMP)*, which costs $13,995. With *SMP*, *VINES* is the only network operating system to take full advantage of powerful servers such as the Compaq Systempro, AT&T StarServer E, and ALR PowerPro DMP that enable the operating system to distribute tasks dynamically across multiple processors.

On the client side, *VINES* can take as much as 110K of RAM, but with MS-DOS 5.0 we were able to shrink that amount to 40K simply by loading the redirector into high memory.

Given its enterprise-wide orientation, it was not surprising that *VINES* proved faster than *Microsoft LAN Manager* and *NetWare* when routing data between servers. It did test slower than the others when moving data between the client and its server, however. The key to *VINES'* server-to-server performance was its efficient use of packet size and protocols.

ARCHITECTURAL HIGHLIGHTS

VINES' multiserver origins begin up front. Thanks to a remote procedure call (RPC) interface, you can develop applications independently of the specific communication protocol. Data transferred through the RPC interface relies on a proprietary transport layer program called the *VINES* Interprocess Communications Protocol (VICP).

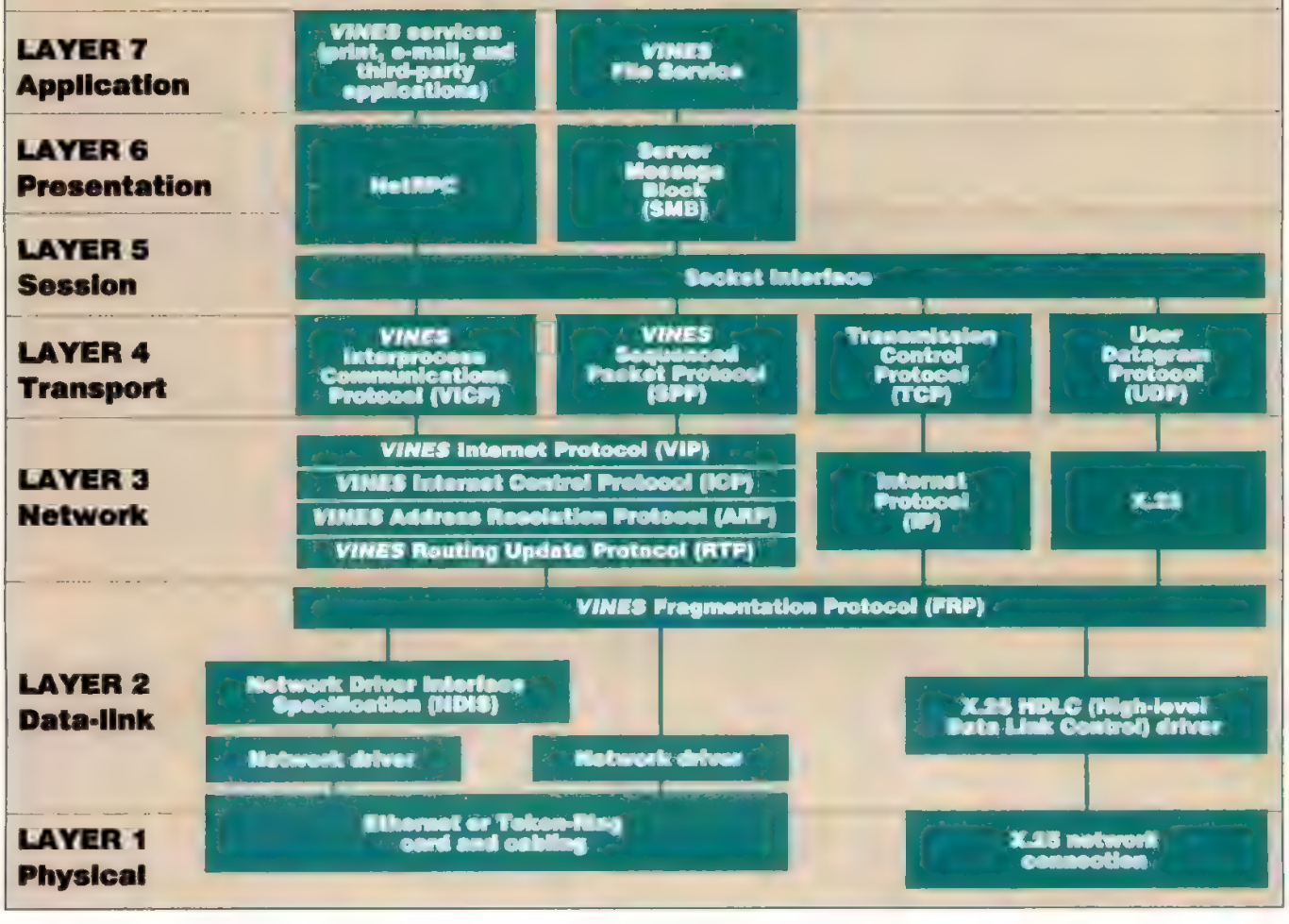
Not all services use remote procedure calls, however. As with *LAN Manager*, *VINES'* file and print services typically use the server message block (SMB) interface. Applications using SMB communicate with a different transport layer program, known as Sequenced Packet Protocol (SPP).

Both SPP and VICP run over NDIS, enabling *VINES* clients to run other protocols such as TCP/IP simultaneously. Banyan markets FTP Software's *PC/TCP* package as an option ($2,995 per server) to give full TCP/IP capabilities to *VINES* client PCs. A $1,995 TCP/IP routing package called *TCP/IP Routing* lets your server act as an IP router.

Aside from NDIS support, Banyan also supplies drivers for practically any high-quality LAN adapter, but check with your dealer to be sure.

VINES ARCHITECTURE

Applications running on top of *VINES* can use either a remote procedure call (RPC) or the Server Message Block (SMB) interface to build network applications.



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Non-DOS clients also have access to the *VINES* server thanks to client software shipped with the network operating system. Platforms include OS/2, Microsoft Windows, and Macintosh. As with *LAN Manager, VINES* enables you to perform all network functions, such as attaching to a server, without having to exit the Windows environment. *VINES Option for Macintosh,* a separate $1,995 per server product for *VINES* 5.0, is available for Macintosh clients.

Once you are set with the right client software and driver for your station, installation should not take long. After *VINES* formatted our Compaq Systempro's hard disk, it took only about 20 minutes to install the software.

The print-job management utility shows the status of print jobs and allows a user to defer or kill a job or move it to a less busy print queue. *VINES* typically moves data between a PC and its locally attached server slower than *NetWare* or *LAN Manager,* primarily because Banyan's layered server operating system runs over an unspectacular Unix file-handling system. A *VINES* server excels, however, at moving requests for service and replies through its internal router and on to other servers. *VINES*' efficient packet sizes and protocols speed interserver communications tasks.

FACT FILE

***VINES*, Version 4.11**
Banyan Systems Inc., 120 Flanders Rd., Westboro, MA 01581; 800-222-6926, 508-898-1000.
List Price: 5 users per server, $1,295; 10 users, $2,495; 20 users, $3,995; unlimited users, $7,495. *VINES SMP* (symmetrical multiprocessing version): unlimited users, $13,995. TCP/IP support, $3,995; SNA gateway support, $1,495; Unix support, $7,495.
Requires: Server: 386-based PC or better, 4MB RAM, 45MB RAM hard disk space. Client: 110K RAM.
In Short: *VINES* shines in large networks with many servers, where it quickly passes data between servers, but it is not as impressive between client PCs and locally attached servers. *VINES*' distributed global naming service, StreetTalk, makes it easy to manage a *VINES* extended network. *VINES* also offers excellent security and TCP/IP interoperability, good reliability, symmetric multiprocessing, and competitive pricing.

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SUITABILITY TO TASK

VINES				
Mac-to-server connectivity	●	●	●	●
DOS-to-Unix connections	●	●	●	○
OS/2 connectivity	●	●	●	○
UPS	●	●	●	○
Administration	●	●	●	●
Security	●	●	●	●

STREETTALK GLOBAL NAMING

Probably Banyan's biggest claim to fame is its StreetTalk distributed global naming service. The StreetTalk database, held at every server, details the name, location, and attributes of every network user and resource, including shared volumes, printers, lists, nicknames, host gateways, and integrated third-party products worldwide. The *VINES* servers pass updates of the StreetTalk database between themselves on a regular basis.

Banyan's naming service works well when you have an all-*VINES* network. For mixed networks, Banyan plans to link StreetTalk to the CCITT X.500 standard. It also plans to develop a *NetWare* Loadable Module that will provide StreetTalk services, making it easier to link *VINES* and *NetWare* servers in a common network environment.

Complementing StreetTalk is VANGuard, *VINES*' security system. Aside from the usual password verification and access rights, VANGuard provides a number of unusual security features. For instance, it authenticates a user's ID before *VINES* performs a significant event, thus preventing an intruder from masquerading as a legitimate user. VANGuard also provides password encryption with no session replay. This feature prevents an intruder from using someone's encrypted password to initiate a session with a server.

VINES has a good reputation for reliability. Although it does not support disk duplexing, it does allow disk mirroring. With third-party software, you can mirror file services onto a duplicate server; if one file server crashes, you can use the other server instead. You cannot mirror printer and name services to a different server, however.

VINES lacks the separate management utilities offered by *NetWare* or *LAN Manager.* But a utility called MNET contains layers of informative menus that you can view from the client or server console. Banyan's approach to SNMP management is a $495 program called the *VINES SNMP Proxy Agent Option* that takes data from MNET, including information about all active *VINES* servers, and acts as a single SNMP agent for the network. AT&T, Cabletron, Hewlett-Packard, and Hughes LAN Systems each offer SNMP management station software that can query this proxy agent.

CONFUSING RELEASES

Confusingly, Banyan released *VINES,* Version 4.11, and *VINES,* Version 5.0, within a month of each other. Banyan had a long-term project to bring Macintosh service into *VINES* (examined in "Across the Great Divide: PC-to-Mac Connections," *PC Magazine,* May 12, 1992) and to improve the file management and file backup utilities.

The company also wanted to improve *VINES*' management of user rights in directories and subdirectories, and it wanted to add the ability to limit access to specific files within a directory. All of these features were released in *VINES* 5.0 in early 1992—too late, however, to be reviewed in this issue.

In the meantime, Banyan released *VINES* 4.11 late in 1991, with support for specific hardware (such as the hard disk array of the Compaq Systempro), OS/2 NetBIOS, Compaq peripherals, V.35 high-speed phone lines, and X.29 inbound communications.

These features did not make it into Version 5.0. Features from both versions should make it into a release scheduled for sometime this year. Meanwhile, servers running either version of the software will interoperate on the same network, but the format of the server's hard disks is different and upgrading from Version 4.11 to 5.0 requires a full backup and disk-reformatting procedure.

Despite these difficulties and lower workgroup performance, *VINES*' multiserver capabilities continue to place it in a tier above *NetWare* and *LAN Manager* in the extended network market. ■

Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine. *Joe Salemi is a contributing editor to* PC Magazine. *M. Keith Thompson is a frequent contributor to* PC Magazine.

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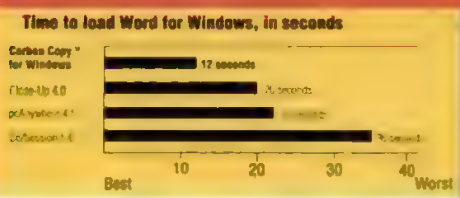

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"In short, Carbon Copy Plus is a reliable remote control product that has plenty of features..." *PC Sources*

"The program [Carbon Copy for Windows] is intuitive, easy to use and endowed with excellent support for Windows workstations over dial-up asynchronous lines." *PC Week*

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by
Joe Salemi

Advisor

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- CORRECTIVE SERVICE DISKS: What are the CSDs that IBM gives out?

MORE ON TDD

Mr. Norman Williams of the Technology Assessment Program at Gallaudet University in Washington, D.C., was kind enough to send more information on TDD (telecommunications devices for the deaf) hardware and software for PCs. Gallaudet, the world-famous university for the hearing impaired, has been a leader in gathering information and encouraging product vendors to expand their lines for people with disabilities.

The Special Needs Information Referral Center sells a $600 internal TDD modem, the IBM Phonecommunicator, that communicates with ASCII or Baudot TDD devices and comes with its own software (P.O. Box 2150, Atlanta, GA 30055; 800-426-2133 voice, 800-284-9482 TDD). Phone-TTY (202 Lexington Ave., Hackensack, NJ 07601; 201-489-7889 voice, 201-489-7890 TDD) sells various types of TDD equipment, including the CM-4 ($350), an external modem that also supports ASCII or Baudot. It is bundled with the company's *Futura-TDD* communications software.

Two other modem vendors bundle Phone-TTY's *Futura-TDD* with their modems. Ultratec's $329 *Intele-Modem* (450 Science Dr., Madison, WI 53711; 608-238-5400 voice/TDD) and Krown Research's $350 SM-90 Smart Modem (129 Sheldon St., El Segundo, CA 90245; 310-322-3202 voice/TDD) are both external modems that support ASCII and Baudot TDD communications.

The Technology Assessment Program (TAP) at Gallaudet offers a freeware program for use with standard modems that lets you communicate with ASCII TDD devices. You can download *ASCII-TDD* from TAP's BBS at 202-544-3623 or receive the program on-disk by sending $3 for postage and handling to Technology Assessment Program, 800 Florida Ave. N.E., #MSSD-200, Washington, DC 20002 (please specify 3.5- or 5.25-inch disks).

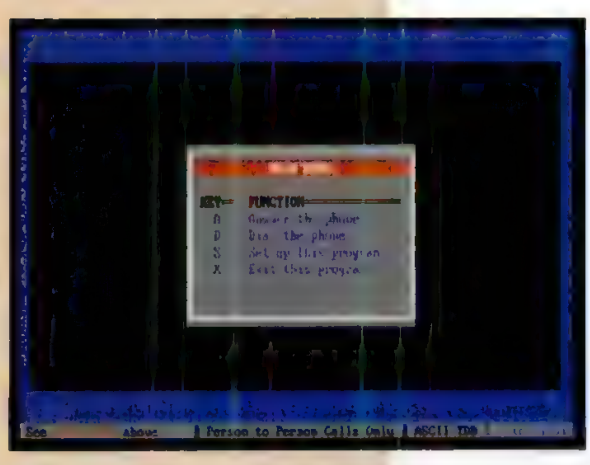

Figure 1: The *ASCII-TDD* software from Gallaudet University is a simple communications program that lets owners of standard PC modems communicate with ASCII TDD devices.

Unfortunately, the telephone number for Microflip was misprinted in the original column on TDD devices for PCs (February 11, 1992); the correct number is 301-262-6020. Microflip's TDD number is 301-262-1629.

CORRECTIVE SERVICE DISKS

I had a problem with my copy of IBM's PC-DOS 5.0, so I called IBM and was sent five "corrective service" disks along with directions for installing them. Are you familiar with these disks, and is this something I should be fooling around with? The service technician told me that a couple of DOS 5.0's features would not work unless these corrected disks were installed.

Paul D. Plotnick
Stamford, Connecticut

Corrective Service Diskettes (or CSDs) is IBM's somewhat obtuse name for patch disks. IBM started distributing CSDs for DOS shortly after releasing its version of DOS 4.0; CSDs are also available for various versions of OS/2. The CSDs contain updated versions of system and utility files, and the installation procedure is pretty straightforward: Just put the first CSD into a bootable disk drive and reboot your machine. The installation program asks a few questions and then proceeds to replace existing files on your hard disk with the updated versions. I've rarely heard of a CSD update failing, but for safety's sake you should do a complete backup of your hard disk prior to installing the CSDs.

CSDs should be available from any IBM authorized reseller/dealer or directly from IBM's technical support center. Call 800-447-4700 for the location of the nearest IBM dealer or 800-336-5430 for direct software support information from IBM. You can also download the latest CSD versions for DOS 4.0, DOS 5.0, and OS/2 1.3 from the IBM National Support Center BBS at 404-835-6600 (2,400 bps) or 404-835-5300 (V.32/9,600 bps).

ASK THE ADVISOR

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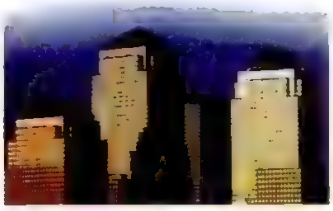

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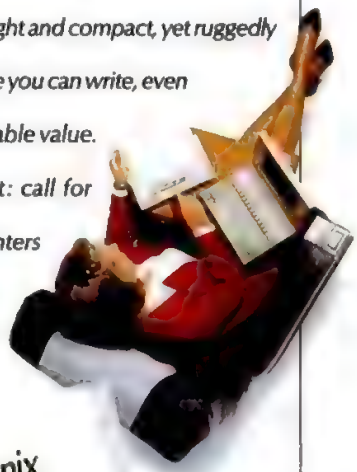

KODAK *Kodak Diconix printers*

CIRCLE 362 ON READER SERVICE CARD

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by
Jeff Prosise

Tutor

EXTENDED MEMORY FROM REAL MODE

Most texts say that a 286, 386, or 486 CPU must switch to protected mode in order to access memory beyond 1MB. However, I've also read that certain design "quirks" in the chips can serve as gateways to extended memory from real mode. Is this true? If so, can you please explain some of the loopholes?

R. Stein
New York, New York

EXTENDED MEMORY FROM REAL MODE: How quirks in 286 and later processors enable you to access extended memory without a switch to protected mode.

PC MAGAZINE Today's real-mode programs use several methods to reach into extended memory. Two techniques require no switch to protected mode. One relies on an address line normally used in protected mode and a quirk in Intel's real-mode segment:offset addressing scheme. The other uses an undocumented processor instruction.

Before proceeding, let's briefly review the mechanics of memory addressing in Intel CPUs. In real mode, the microprocessor forms a physical memory address by shifting the value held in a 16-bit segment register 4 bits to the left, effectively multiplying it by 16, and then adding the 16-bit offset. The result is a 20-bit memory address that may lie anywhere within the microprocessor's 1MB real-mode address space.

Protected mode adds a level of indirection. Segment-register contents are interpreted much differently, with 13 of the 16 bits used as an index into a table containing values called *descriptors*. Each descriptor defines one block (or segment) of memory, including its base address and *limit* (or length). On the 286, the base address is a 24-bit quantity and the limit is 16 bits, so a segment can lie anywhere within a 16MB address space (2^{24} equals 16MB) and can be as large as 64K (2^{16} equals 64K). On the 386 and 486, both the base address and limit are 32-bit values, so the address space is 4GB in length and individual segments of memory may be as large as 4GB.

A typical system contains several descriptor tables: one global descriptor table (GDT) normally used by the operating system and several local descriptor tables (LDTs), which define segments of memory allocated to programs by the operating system. In protected mode, a physical address is formed by adding an offset (16 bits on a 286, 16 or 32 bits on a 386 or 486) to the base-segment address contained in the segment descriptor. If the offset exceeds the limit specified in the segment descriptor, a protection fault occurs that disallows the operation, notifying the operating system that an illegal access was attempted.

THE HIGH MEMORY AREA

The primary reason that extended memory can't be accessed from real mode is that the 20-bit address generated from a segment:offset pair can't form an absolute address higher than 1MB. Or can it?

When you think about it, the highest address you can form with a 16-bit segment and offset is FFFF:FFFF, which is clearly beyond the 1MB mark. (For reference, F000:FFFF is the address of the last byte in conventional memory.) In fact, FFFF:FFFF is equal to absolute address 10FFEFh—just 16 bytes short of a full 64K beyond 1MB.

If you attempt to use this bit of segment:offset addressing magic to access extra memory on an 8086 or 8088, though, the address simply wraps around to the bottom of memory. 10FFEFh becomes FFEFh because the CPU lacks the extra address lines it takes to read or write more than 1MB of memory. (An *address line* is the physical connection between the CPU and the portion of the system bus that carries addresses.)

The number of memory locations that a CPU can address is equal to 2^n power, where n represents the number of address lines. The 8086 and 8088 support a maximum of 20 address lines, so they are limited to addressing 1,048,576 bytes, or 1MB of RAM.

Even if you attempt this trick to access extended memory on a 286, 386, or 486, the address will still wrap around to low memory—unless, that is, you first enable the 21st address line (termed the *A20 line*). Normally disabled in real mode, it is possible to enable the A20 line on many PCs and then use the normal segment:offset addressing to access all but the first 16 bytes of the lowest 64K of extended memory. This region is called the *high memory area*, or simply the HMA.

This, then, shows one way to access extended memory without leaving real mode: Enable the A20 address line and use the fact that segment:offset addresses can go as high as FFFF:FFFF to reach into memory beyond 1MB. The easy way to do it is to use HIMEM.SYS, which offers services for enabling and disabling the A20 line and for allocating and deallocating the HMA.

Not only does HIMEM.SYS provide a device-independent means for manipulating the A20 line (which is important, because the actions required to turn A20 on or off vary from PC to PC), but it also regulates access to the HMA. Only one program can claim this region; others are denied its use until the program that owns the HMA releases it.

The most common example of a program that employs this means of accessing extended memory without leaving real mode is DOS 5.0. When the DEVICE= command that loads HIMEM.SYS is accompanied by the statement DOS=HIGH elsewhere in CONFIG.SYS,

DOS loads its kernel into the HMA rather than into conventional memory. If the BUFFERS setting is 48 or less, DOS's disk buffers also go into the HMA. When the BUFFERS setting is 44 or less, part of COMMAND.COM goes in the HMA, too.

To access any of these, DOS enables the A20 line and reads from or writes to extended memory using standard segment:offset addressing. When it's done, DOS restores the A20 line to its original setting so its actions won't interfere with other programs.

THE LOADALL INSTRUCTION

The second real-mode mechanism that programs sometimes use to access extended memory is the undocumented CPU instruction LOADALL. Unlike the previous method, LOADALL permits a real-mode program to access any location in extended memory—not just locations within the first 64K.

To understand LOADALL, you must first understand what happens when the CPU executes an instruction that references a memory location. In protected mode, the value in a segment register is used to retrieve a segment descriptor from a table of segment descriptors. The descriptor, in turn, holds the information that is needed to form a physical memory address.

Descriptor tables are stored in memory, so it would seem that every memory access would actually require two memory accesses: one to retrieve the segment descriptor and one to access the resulting memory location. To eliminate redundant memory accesses, the 286, 386, and 486 cache descriptors retrieved from the LDT or GDT in shadow registers known as *descriptor caches*. There is one descriptor cache for each segment register. When a memory location is referenced, the CPU uses information in the descriptor cache to compute the physical memory address. The cache is updated whenever a segment register is modified, so only reloading a segment register causes an extra memory access.

The LOADALL instruction loads all the CPU registers and descriptor caches with values from a table stored at absolute address 800h in real-mode memory. The format of the table differs between 286 and 386 CPUs (the 486 uses the same format as the 386), but the principle is the same. Using LOADALL, a program can manually load the descriptor-cache registers with values that enable it to access any location in memory. The effect is the same as if the program were running in protected mode and had just loaded the segment registers with valid descriptor table indexes. No shift to protected mode is required, though.

The only catch is that interrupts must be disabled while extended memory is being read or written. Otherwise, an interrupt service routine (ISR) could intervene and modify a segment-register value, destroying the data that has been placed in the associated descriptor cache by LOADALL. Unfortunately, this has unwanted implications for programs that rely on hardware interrupts—communications programs that use interrupts from the serial port to read and write data asynchronously, for example.

Does anyone really use the LOADALL instruction? Microsoft's RAMDRIVE .SYS RAM disk driver reportedly uses it to move data between conventional and extended memory. I suspect that SMARTDRV.SYS and HIMEM.SYS do, too.

Don't bother to look for LOADALL in any of your Intel reference manuals. It was never documented in the official literature, probably because it was intended primarily for engineers debugging the chip, not for programmers. Nor is it recognized by MASM.

On the 286, LOADALL is implemented as the opcodes 0Fh 05h; on the 386 and 486, it uses 0Fh 07h. Interestingly, some 386 and 486 BIOSes trap the invalid opcode exception that occurs when the 286 form of the LOADALL instruction is executed, and they emulate its actions, presumably by calling upon the 386/486 LOADALL instruction. In any event, LOADALL is not something the casual programmer will be interested in exploring. If you would like to learn more, consult Robert Hummel's *Programmer's Technical Reference: The Processor and Coprocessor* (1992, Ziff-Davis Press). This book contains information on several undocumented processor instructions, including LOADALL and the XBTS and IBTS instructions that were briefly discussed in the February 11, 1992, Tutor column.

CORRECTION

The February 11, 1992, Tutor column presented a short utility, 386STEP, that identifies step B0, B1 and D0 386 Intel processors by looking for chip bugs. Unfortunately, a pair of typographical errors in the source code listing resulted in a bug in 386STEP itself. While not severe—it doesn't cause 386STEP to identify stepping levels incorrectly—it is a bug nonetheless and should be swatted.

In the section of 386STEP.ASM that checks for a 486 by attempting to toggle the 486's alignment check bit, the following line

```
mov  ebx,esp
```

should have read

```
mov  edx,esp
```

Near the end of the same section, the line

```
mov  esp,ebx
```

should have read

```
mov  esp,edx
```

Saving the value of ESP in EBX was a mistake because EBX is modified in the body of the routine. Changing EBX to EDX corrects the problem, since register EDX is otherwise unused.

If you downloaded the 386STEP.COM utility from PC MagNet or typed in 386STEP.SCR, you can easily patch 386STEP.COM with the following commands:

```
DEBUG 386STEP.COM
E 016D D4
E 01A4 E2
W
Q
```

The revised versions of 386STEP.ASM and 386STEP.COM can also be downloaded from PC MagNet. My apologies for any inconvenience this may have caused.

ASK THE TUTOR

The Tutor solves practical problems and explains techniques for using your hardware and software more productively. Questions about DOS and systems in general are answered here. Send your question to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload it to PC MagNet (see page 10 for instructions). We regret that we can't acknowledge submissions or answer questions individually. ■

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CIRCLE 191 ON READER SERVICE CARD

by
Neil J. Rubenking

User-to-User

- DOS 5.0's /F SWITCH: Don't let an inactive printer halt your batch files.
- COMMENTING CONFIG.SYS: DOS 5.0 has an undocumented CONFIG.SYS command that can help you foil invasive INSTALL programs.
- FINDING THE ENVIRONMENT SIZE: This batch file provides a quick estimate of the space currently used by environment variables.

DOS 5.0's /F SWITCH

I read the October 29, 1991, column about changing the printer time-out value, and that made me wonder if there is a way to get DOS to ignore the printer port if no printer is active.

I have a laser printer that can be switched between PostScript and HP emulations with software commands. I've added these commands to the batch files I use to start various programs. But if I run the batch files when the printer is off, of course I get DOS's "Abort, Retry, Fail" message, effectively stopping the routines. Is there anything I can do to bypass this message? (I use DOS 5.0.)

John Seiffer
Plano, Texas

PC MAGAZINE DOS 5.0 has a handy undocumented feature that will help you here. If you start COMMAND.COM with the command line switch /F, it will automatically answer "Fail" to any ARF (Abort, Retry, Fail) queries. You can experiment with this switch easily: Just invoke a secondary command processor by typing `COMMAND /F`. Now try listing the directory of an empty floppy disk drive; you will still get several ARF queries, but DOS will answer Fail to each one. The same thing happens if you attempt to copy a file to the printer when it is turned off: DOS will answer Fail to the ARF query, and your batch file will continue. Of course, your printer won't be initialized, but the batch file won't halt because it's waiting for your response.

To make this behavior standard on your system, add /F to the SHELL= line in your CONFIG.SYS file. If you don't have a SHELL= line, create one. Mine looks like this:

```
SHELL=C:\DOS\COMMAND.COM C:\DOS\
 /E:512 /F /P
```

The first argument on the SHELL= line is the full pathname for your command processor; I keep mine in the DOS directory to avoid cluttering the root directory. The second is the path for the command processor *without* the actual filename; this argument causes DOS to set the COMSPEC environment variable to the full pathname of your command processor. The /E:512 switch gives me a 512-byte environment, the /F switch causes DOS to fail ARF queries automatically, and the /P (for permanent) is required on the SHELL= line.

COMMENTING CONFIG.SYS

Many applications search CONFIG.SYS during their install routines for, say, FILES=40 or BUFFERS=25. If they don't find what they're looking for, they insert it directly into your CONFIG.SYS. I hate to install programs that actually change my setup and then force me to reboot, but they exist.

Some of these programs simply look for any occurrence of a FILES or BUFFERS statement, while others look for the last occurrence (the one DOS uses to set the values), so I needed a way to fake out either method. I use BUFFERS=3 since I have a disk cache, and FILES=8 (the minimum value) since I load the FILES high later on.

I solved the problem using an undocumented CONFIG.SYS command. In DOS 5.0, the line COMMENT= followed by two characters tells DOS to ignore all subsequent lines that begin with those two characters. By including the line FILES=40 preceded by COMMENT=FI, I can fake out these install programs. It makes sense to place these lines at the end of the file; you don't want to comment out a line that you need.

You can use this technique to comment out any line, but REM works just as well. If you do use COMMENT= early in the CONFIG.SYS file, you can disable it afterward by including COMMENT=*x*, where *x* is a graphic character or something other than one of the normal 52 characters. I don't think that COMMENT is case-sensitive.

Carl L. Holmes
Haverhill, Massachusetts

PC MAGAZINE Install programs that rudely modify your AUTOEXEC.BAT and CONFIG.SYS files are unpleasant at best, but they are a fact of life. It's a good idea to maintain up-to-date copies of those two files somewhere other than the root directory so you can undo any damage inflicted by an impolite install routine. This will provide as much protection as "faking out" the install programs with the COMMENT= line, and it will work with other DOS versions as well.

Still, knowing about undocumented DOS commands always gives you a feeling of power. After a bit of experimentation and much rebooting, I determined that the COMMENT= command in CONFIG.SYS is not case-sensitive and that only the first two characters following the equals sign are significant. For example, the line `COMMENT=Fiddlesticks` will cause DOS to ignore FILES= and any other subsequent lines

beginning with the letters "fi." COMMENT= lines are not cumulative; if you add another later in the file, it replaces the first one.

Mr. Holmes probably discovered the COMMENT= command by examining DOS 5.0's IO.SYS file with DEBUG. The string COMMENT appears in the list of CONFIG.SYS commands, after INSTALL and before REM. DOS 4.0's IBMBIO.COM also contains COMMENT in this list, so the technique may work under that DOS version as well.

FINDING THE ENVIRONMENT SIZE

I frequently run into DOS's "Out of environment space" error message when I'm setting up a PC for the first time or installing new software. When this happens, I have to go hunting for the DOS manual that matches the version of COMMAND.COM on the PC. It's often tempting to set aside 512, 768, or 1,024 bytes for the DOS environment and then forget about it.

It would be great to be able to go back later and trim down the environment to the size that's actually required, but how do you know how much space is being used without counting each byte? The batch file ENVSIZE.BAT (Figure 1) is a quick and dirty way to see how many bytes of the DOS environment are being used at any given time.

You can use a similar technique to find the number of bytes used by the DOS PATH environment variable. Not only does the PATH contribute to the total environment size, it is limited to 127 bytes. So finding out how many bytes your PATH is using helps you judge when the time is right to start shortening some directory names or to try out the ASSIGN command for the first time. Just copy ENVSIZE.BAT to PATHSIZE.BAT and change `SET > ENVSIZE` to `PATH > PATHSIZE`. Then change all other occurrences of ENVSIZE to PATHSIZE. Put both batch files in a directory in your path.

Rick Lee
Edmonton, Alberta, Canada

ENVSIZE2.BAT — COMPLETE LISTING

```
@ECHO OFF
IF NOT '%1'==='' GOTO SecondTime
REM ===  Show size of DOS Environment being used  ===
SET > ENVSIZE2.
DIR ENVSIZE2. | FIND "ENVSIZE2" > TEMPENV.BAT
TEMPENV
:SecondTime
ECHO Environment variables use approximately %1 bytes.
DEL TEMPENV.BAT
DEL ENVSIZE2.
```

Figure 2: This batch file automates the process of reporting the number of bytes used by environment variables.

The SET command displays the DOS environment variables on-screen in almost exactly the same format DOS uses to store them in memory. In both cases, each variable name is followed by an equals sign and the value of the variable. SET generates a CR/LF (carriage return/line feed) pair of characters after each variable. In memory, the variables are separated by an ASCII 0 byte, and a pair of ASCII 0 bytes signals the end of the environment. Hence, the size of the ENVSIZE file is almost exactly the actual environment size. In the file, each variable is followed by two bytes (CR/LF) as opposed to one (ASCII 0) in memory; also, the file does not take into account the pair of ASCII 0 characters that ends the environment. To get the precise amount of environment space in use, take the size of the ENVSIZE file, add two, and subtract the number of environment variables. In most cases, though, the difference won't be significant.

To automate the process further, I created ENVSIZE2.BAT, shown in Figure 2. To run it, type ENVSIZE2 with no command line parameters. Because there are no parameters, the IF test in the second line fails, and control passes to the next line, which redirects the output of the SET command into the file ENVSIZE2. The following line calls DIR to report the directory of that file and uses FIND to filter out all lines of the DIR output except the one relating to ENVSIZE2; it redirects the filtered output into the file TEMPENV.BAT.

TEMPENV.BAT now contains a line like this:

```
ENVSIZE2        115 12-30-91   1:03p
```

which is the directory information for the ENVSIZE2 file. ENVSIZE2.BAT executes TEMPENV, which in turn executes ENVSIZE2.BAT again—this time with the directory information on the command line. Now the IF test on the second line is true, and control jumps to the label SecondTime. At this label, an ECHO command reports the first command line parameter, which is the size of the ENVSIZE2 file. Then it cleans up by deleting that file and the temporary batch file. Note that in order for this batch file to work, the temporary file must have the same name as the batch file and no extension.

ENVSIZE.BAT — COMPLETE LISTING

```
ECHO OFF
REM ===  Show size of DOS Environment being used  ===
CLS
SET > ENVSIZE.
ECHO Number of bytes used by DOS Environment
ECHO    shown by file size of ENVSIZE
DIR ENVSIZE.
DEL ENVSIZE.
```

Figure 1: This batch file creates a file whose size approximates the number of bytes in use by environment variables.

SHARE YOUR SECRETS

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by
Fran Finnegan

Windows

LPT1: VERSUS LPT1.OS2

Recently, I upgraded to a 25-MHz Gateway 2000 386 computer and soon afterward I discovered a peculiar problem with Windows 3.0. My system has the standard Gateway configuration for this model, and my printer is an old STAR SG-10 connected to LPT1:.

The problem I ran into was that I could not print anything from within Windows, even though all my DOS applications (such as *WordPerfect* 5.1 and *Lotus 1-2-3* Version 3.1) would print with no problems at all.

Within Windows, the printer was configured for an Epson 9-pin driver, which is fully compatible with the STAR printer. But using the LPT1: port in the Control Panel setup procedure for the printer would not work. Every attempt I made to print in Windows failed. I had the same problem whether trying to print from *Excel, Word for Windows*, or any other Windows application. Windows responded to print commands either with a message claiming that the printer was stalled or with an "Error: Check printer connections" message. A technician from Gateway 2000 suggested using the LPT1.OS2 port rather than the regular LPT1: port, and this immediately corrected the problem.

Could you please explain the difference between the LPT1: and the LPT1.OS2 ports, and why switching to the LPT1.OS2 port corrected the problem I had with my printer?

Mark W. Cundik
Youngstown, Ohio

WIN.INI — PARTIAL LISTING

```
[ports]
LPT1:=
LPT2:=
LPT3:=
COM1:=9600,n,8,1,x
COM2:=9600,n,8,1,x
COM3:=9600,n,8,1,x
COM4:=9600,n,8,1,x
EPT:=
FILE:=
LPT1.DOS=
LPT2.DOS=
```

Figure 1: The Windows 3.1 WIN.INI file's default [ports] section.

■ LPT1: VERSUS LPT1.OS2: What's the difference between these two ports?

By connecting a printer to the LPT1.OS2 port in Windows 3.0 (or LPT1.DOS in Windows 3.1), you are instructing Windows to bypass its internal parallel-printer-port driver and print directly to a "file" named LPT1.OS2 (or LPT1.DOS). As you can see in Figure 1, which shows the Windows 3.1 WIN.INI file's default [ports] section, Windows allows you to connect your printer drivers to various kinds of ports. If you are connected to the LPT1: port, Windows interprets that as a request to use its internal parallel-printer-port driver. If you connect to the LPT1.OS2 port (or LPT1.DOS) instead, Windows interprets that as a request to print to a file of that particular name. The distinction is that there is no colon in the "port" name; Windows instead treats the "port" as if it were a file.

Because all file requests in Windows are handled by DOS, LPT1.OS2 (or LPT1.DOS) is passed to DOS as a filename. But whenever DOS receives a request to open a file, it first checks to see if there is a character device with that name (ignoring the extension). If there is, it opens the device. Therefore, DOS won't write to a file that has the same name (not including the extension) as one of its reserved port names, and LPT1 is one of these names.

Instead, DOS will route the output to the physical LPT1: port as supported by your computer's BIOS (Basic Input/Output System). The extension on the filename is entirely irrelevant because devices don't have extensions; DOS just checks the eight-character filename against the names of the installed devices. Consequently, it doesn't matter whether the extension is .OS2 or .DOS or something else.

Since Microsoft no longer supports OS/2, it has changed the extension in the WIN.INI file's [ports] section to .DOS in Windows 3.1. Originally it was .OS2, indicating that you had to use this "port" name if you were running Windows under OS/2 1.*x* and wanted to print. Windows' internal parallel-printer-port driver will not operate under OS/2, which is what made this "port" necessary.

The reason this corrects your problem is that your BIOS is not as finicky in dealing with the LPT1: port as is Windows' internal parallel-printer-port driver. This problem usually occurs when you do not have an exact match between your physical printer and the Windows driver that you are using, which is the case on your system. Your BIOS doesn't care which printer is connected to LPT1:, but Windows does. As with OS/2, Windows is more sensitive about your hardware than DOS and your BIOS.

In your case, Windows doesn't think your printer is fully compatible with the one that the Windows printer driver is designed for.

OPENING WINDOWS

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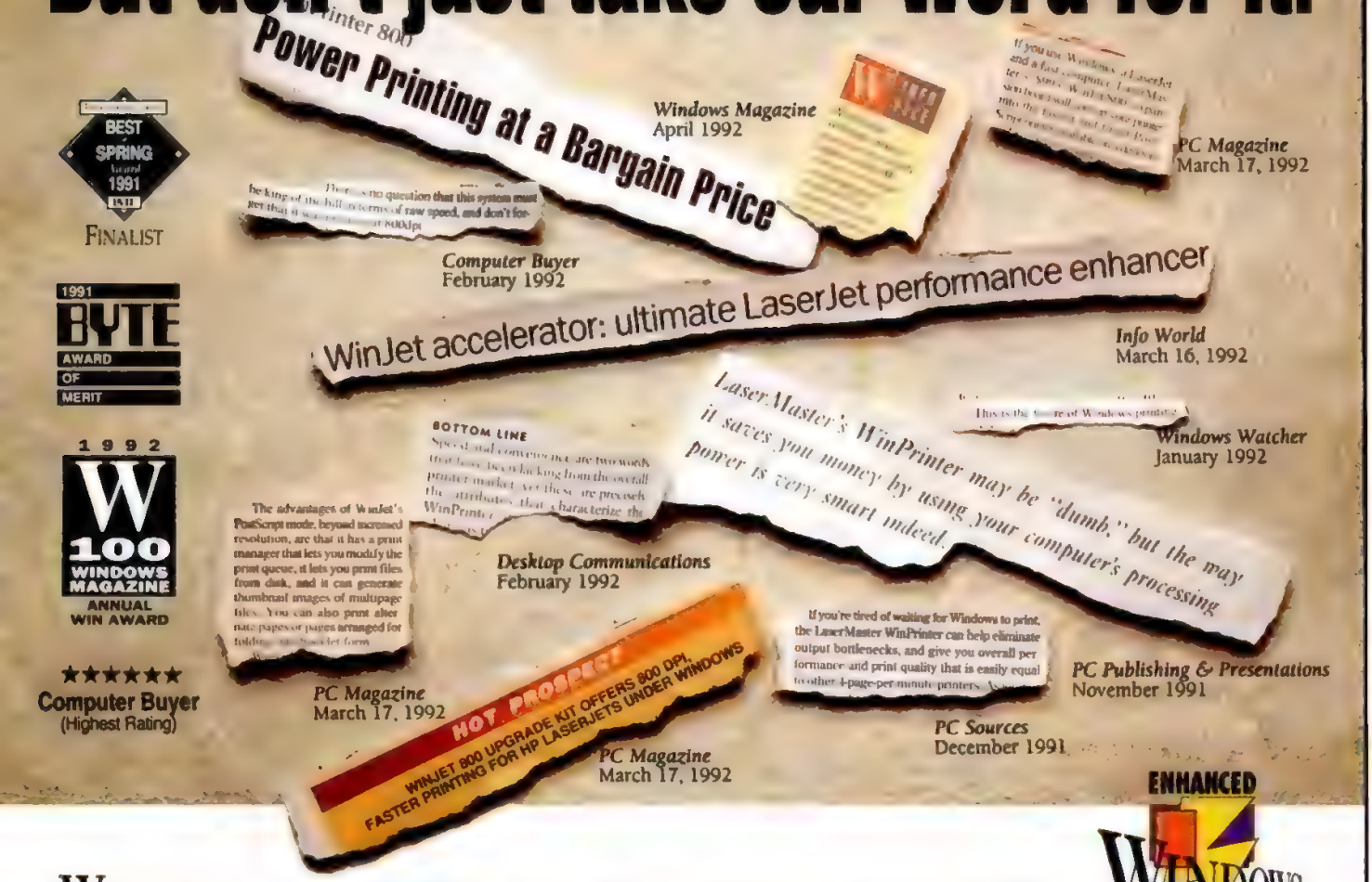

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CIRCLE 237 ON READER SERVICE CARD

by
Craig Stinson

Spreadsheets

AUTOMATED LABEL ENTRY IN QPRO

In using *Quattro Pro* I would like to define an entire column as labels rather than values, so that I could use catalog numbers such as 0604-23 without their being treated as numeric expressions. I know I can use /Database | Data Entry to mark a block in that fashion, but that requires knowing both endpoints of the block—not possible in an ever-changing spreadsheet! I'm sure there's a simple way to do this, but at the moment it eludes me.

Dan Shackelford
Fullerton, California

A one-line macro is the simplest way to get the job done. Just enter the following line anywhere on your worksheet:

```
{?}{d}{branch \L}
```

Assign the name \L to the macro cell, move to the first cell in which you want to enter a label, and press Alt-L. The macro will type the left-alignment label prefix and wait for you to enter your label. When you press Enter, the macro will accept the label, move down one row, type another label prefix, and so on. When you've finished typing labels, press Ctrl-Break to end the macro.

When typing this macro code, you must begin by pressing the apostrophe key twice. The first apostrophe is required because all macro code must be entered as labels. The second apostrophe is the one the macro will play back when you press Alt-L.

- AUTOMATED LABEL ENTRY IN QPRO: The easy way to enter a whole column of labels.
- FAST RECALC TRICK: How to recalculate only the cells you're interested in.

Quattro Pro emits a rather shrill two-pitch beep when you terminate macro execution by pressing Ctrl-Break. If that displeases you, try the slightly more elaborate macro shown in Figure 1.

After typing Figure 1's instructions in two adjacent columns, use the /Edit | Names | Labels | Right command to assign the names \M and ENTRY to the cells that lie immediately to the right of your \M and ENTRY labels. (In Figure 1, those cells are B1 and B5, respectively, but you can enter the macro in some other part of your worksheet if you want.)

When you press Alt-M to execute the macro, you'll be prompted to enter a label. Type anything you want—numbers, letters, or a mixture—and press Enter. Like the simpler macro, this one will accept your input, move down, and await another label. But with this version, you can quit by simply typing either an upper- or lowercase x.

Warning: Entering and using innocuous little macros of this sort can get you hooked on macro programming!

QLABEL.WQ1 — COMPLETE LISTING

```
     A                    B
1    \M        {Getlabel "Enter a label (or press X to quit)",ENTRY}~
2              {if @UPPER(ENTRY)="X"}{quit}
3              '{ENTRY}{d}{branch \M}
4
5    ENTRY
```

Figure 1: Format sequential entries in a column as labels, using this short macro.

FAST RECALC TRICK

In the course of my work, I manipulate large *Lotus 1-2-3* worksheets—usually about 1MB or larger—on an 8-MHz 286 without a coprocessor. To avoid long delays, I set the default recalculation to Manual with /Worksheet Global Default Recalculation Manual. When I need to modify a series of numbers for a "what if" analysis, instead of recalculating the whole worksheet and waiting several minutes for an answer, I simply highlight the cell I'm interested in and press F2, followed by Enter. Going into Edit mode and then back to Ready mode updates the cell with the actual figure in a few keystrokes, instead of the minutes required for a full manual recalculation.

Steven Clark
Columbia, Maryland

It's important to note that going in and out of Edit mode updates the *current cell only*. Cells whose values depend on the value of the current cell are not recalculated by this method. Under carefully controlled circumstances, however, you can use the {recalc} macro command to update a specified portion of a worksheet.

The {recalc} command takes a single argument, which can be either a single cell or a range. You can express this argument either with row and column coordinates or with a name. For example, if you've assigned the name BOTTOMLINE to A100..F100, then you can update this range with either

```
{recalc A100..F100}
```

or

```
{recalc BOTTOMLINE}
```

Just enter this command in any worksheet cell that has a blank cell below it. Then give the cell containing the macro command a name consisting of the backslash character plus another letter. Then with a

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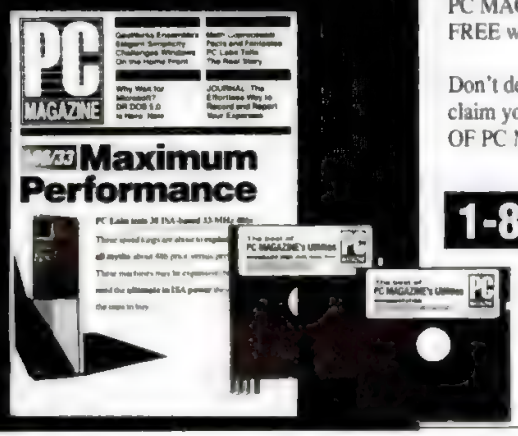

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simple Alt keystroke, you will be able to update the specified range without sending the whole worksheet into a recalc. For example, if the cell containing the {recalc} command is named \B, you can recalculate the specified target range by pressing Alt-B.

If you're using the {recalc} command in any version of *1-2-3* prior to Release 3.0, you will need to add two more commands to the macro code, like this:

```
{recalc BOTTOMLINE}{windowsoff}
{windowson}
```

That's because *1-2-3*, Release 2.*x*, does not automatically update the screen display after a {recalc} command. Including {windowsoff} and {windowson} forces a screen update. (These additional commands are not required with Release 3.*x*, *1-2-3 for Windows*, or *Quattro Pro*.)

Using {recalc} to update a subset of your worksheet has one significant hazard, though. When you recalculate by the normal methods (pressing F9 or using automatic recalculation), *1-2-3* keeps track of all dependencies on the worksheet, regardless of how the worksheet is arranged. If A1's value depends on A10's, which in turn depends on the outcome of B6, the program makes sure that B6 is current before updating A10 and updates A10 before dealing with A1. The program does not follow this "natural" recalc path when using {recalc}. Instead, it recalculates the specified worksheet area row by row. Given the dependencies described above, therefore, the macro command {recalc A1..B10} would not produce a reliable update. B6 and A10 would be correct, but A1 would not. If you lay out your worksheet so that consequent cells always lie below or to the right of their antecedents, you will have no trouble with {recalc}. If you like to put your bottom line at the top, so to speak, you should better stick with F9.

HINTS, TIPS, QUESTIONS

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by
M. David Stone

The Working Word

REMOVE PAGE BREAKS IN WORD

One of *Microsoft Word*'s most frustrating features is the way it paginates when you have auto-pagination off. After paginating a document, page breaks stay visible, interrupting the flow of thought and cluttering the screen with inaccurate page breaks until you paginate again. You can, however, get rid of the page breaks by selecting the whole file and copying it to another window. Simply select the entire document, delete it to scrap, open a new window, insert from scrap, then repeat the process to copy the document back to the original window. You might also want to insert a bookmark first so you can find your place easily.

Chris Darling
Sherman Oaks, California

PC MAGAZINE If the page breaks on-screen annoy you, there's a much easier way to get rid of them: Simply select the whole document with Shift-F10, delete it to scrap with Delete, and reinsert it in the same window with Insert (or Shift-Insert in *Word* 5.5 if you have set the Insert key for toggling between overtype and insert mode). That's three keystrokes in all.

For most users, however, the page breaks are a welcome feature rather than an annoyance. If you're entering handwritten changes from a printed copy of your text, turning automatic pagination off makes it easy to find the right page to make changes on, since printed pages and screen pages will match even when you change the length of your document drastically.

If you turn automatic pagination on, *Word* will dynamically repaginate your document; this gives you feedback about changes in the length as you work. You can turn automatic pagination on by choosing Options and setting Paginate to Auto in *Word* 5.0, or choosing Utilities cUstomize, then Background pagination in *Word* 5.5.

- REMOVE PAGE BREAKS IN WORD: *Microsoft Word* inserts page breaks even when auto-pagination is off. If these annoy you, here's how to get rid of them.
- EQUATION EDITOR MACROS: Some hints on using macros with *WinWord* 2.0's Equation Editor and a macro for easy access to it.

EQUATION EDITOR MACROS

People whose writing involves numeric equations will find the Equation Editor in *Word for Windows* 2.0 well suited to its task—much more friendly and more capable than the equation fields in *WinWord* 1.*x*. Using the Equation Editor would be even easier if there were a way to assign one of the Toolbar buttons to an "Insert-Equation" command.

The dialog box for assigning Toolbar buttons offers commands for InsertDrawing and InsertChart, but only an InsertObject command for all other OLE (object linking and embedding) objects. One compromise is to assign InsertObject to a Toolbar button. When you click on the button, *WinWord* opens the Object dialog box and you can choose Equation from the list of object types. But since this is a bit awkward, is there any command you can assign to a button that will open the Equation Editor directly?

Dan O'Connor
Reno, Nevada

PC MAGAZINE *WinWord* has no built-in command that will call on the Equation Editor directly. However, you can create a macro for the task and then assign the macro to a Toolbar button—or to a shortcut key or menu, for that matter.

The easiest way to create the macro is to record it. First choose Tools | Record Macro, enter an appropriate macro name in the dialog box (InsertEquation would be a good choice), and optionally specify a shortcut key and description for the macro. Then choose OK to close the dialog box and start recording.

Next, choose Insert Object, Equation and then OK to call up the Equation Editor, and immediately choose Tools | Stop Recorder from the *WinWord* menu bar. (Note that you could go on to create an equation and still wind up with exactly the same macro. I'll come back to this point shortly.)

At this point, you'll be back at the document-editing screen. You'll also have a macro available to assign to a Toolbar button or to a menu. To assign it to a Toolbar button, choose Tools Options, then Toolbar (in the Category list box). Make sure the option in the box labeled Show is set to Macros rather than Commands. Then follow the same procedure as you would to assign a command: Select a position for the new button in the Tool to Change list box, select the button to use in the Button list box, select the Insert-Equation macro in the Macros list box, and choose the Change button.

If you would like to assign the macro to a menu, too, change the selection in the category list to Menus, and again make sure the option in the Show box is set to Macros. Then use the appropriate list boxes and text boxes to select the Insert-Equation macro, select the menu you want the macro added to, and enter the menu text for the macro. (Good choices would be Insert for the menu and Insert E&quation for the menu text. The ampersand indicates that you can type the letter immediately after—in this case a *q*—to choose the menu item.) As always with *WinWord*, when you finish making changes, choose File Save All to save your customizations.

As I've already mentioned, you'll wind

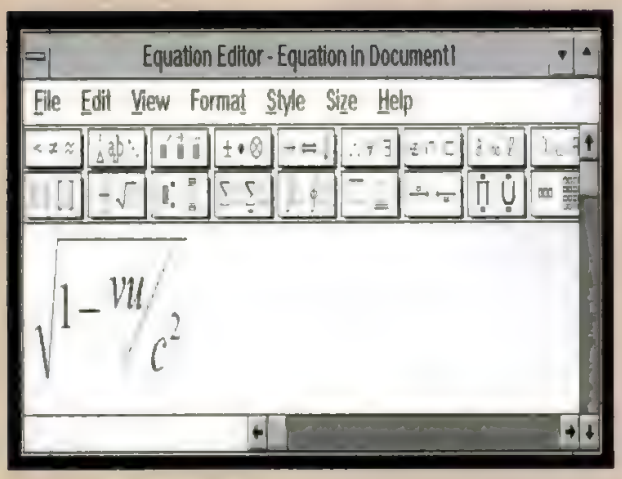

Figure 1: This equation in the Equation Editor was produced by a *Word for Windows* 2.0 macro that included a SendKeys command.

up with exactly the same macro whether you simply call up the Equation Editor or take the time to create and insert an equation. In either case, if you take a look at the recorded macro (by choosing Tools Macros and then selecting the macro and choosing Edit) you'll find that the macro consists of a single command between the Sub Main and End Sub statements:

```
InsertObject .Class = "Equation"
```

Because the Equation Editor is a separate application, the *WinWord* macro recorder ignores anything you do while in the Equation Editor.

This presents a problem if you're creating a series of equations in which a complex set of elements appears repeatedly. In this situation, you could benefit from a macro that not only opens the Equation Editor but inserts part of the equation. Alas, there is no way to record such a macro, and you won't find a macro feature in the Equation Editor itself. Yet there are at least two ways around this limitation.

One choice is to edit the *WinWord* macro by adding a SendKeys command. *WinWord* will then send the specified keystrokes to the Equation Editor after you open it—just as if you had typed the keys yourself. The SendKeys command takes the form

```
SendKeys "Keys", Wait
```

where the *Keys* argument holds the keystrokes that are to be sent, and the *Wait* argument, entered as -1, tells *WinWord* to wait for all of the keystrokes to be processed in an outside application before continuing.

You can use SendKeys to send commands as well as text. SendKeys recognizes special meanings for the plus sign (+), the percent sign (%), and the caret (^). The plus sign is equivalent to holding the Shift key down while typing another key, the percent sign works this way for the Alt key, and the caret for the Ctrl key. SendKeys also recognizes special codes for nonprinting characters; for example, {enter} stands for the Enter key, {down} stands for the Cursor Down key, and so on. You can find the full list of special characters in *WinWord*'s Help. From the Help Index, pick WordBasic Programming Language, then SendKeys; or, if you're working in a Macro Edit window, you can type SendKeys on a line by itself, and with the cursor on that line hit F1.

As an example of what you can do with SendKeys, Figure 1 shows the Equation Editor with an equation produced by the SendKeys statement

```
SendKeys "^r1-^/vu{down}c^h2", -1
```

This statement is equivalent to typing Ctrl-r (the Equation Editor's shortcut key for the radical), then 1 and a minus sign, Ctrl-/ (the shortcut key for a fraction), *vu* for the fraction numerator, the Cursor Down key to move to the denominator, then c, Ctrl-h for a superscript, and finally 2. (Here again, the SendKeys command goes just before the InsertObject command. Note that the ^r and ^h must be lowercase.)

Be aware that because SendKeys interprets the plus, percent, and caret characters as commands, you can't simply enter those characters in a SendKeys argument. Instead, you have to enter the plus sign as += (meaning Shift–Equal Sign), the percent sign as +5 (Shift-5), and the caret as +6 (Shift-6).

The second choice for entering all or part of an equation through a macro is to use the *WinWord* glossary. Although it's not an obvious option, you can store an equation as a glossary entry. First create the equation with the Equation Editor and insert it into a document. Then highlight the equation, choose Edit Glossary, enter a glossary name, and choose Define.

With the equation defined as a glossary entry, you can insert it into a document as with any other glossary entry. Once it's inserted from the glossary, you can edit the equation in the Equation Editor by double-clicking on it or by highlighting it and choosing Edit Equation Object. Even better, you can create a macro that will insert the equation from the glossary and automatically take you to the Equation Editor for further editing. If you create the macro by recording, you'll have to select the equation with the keyboard, because *WinWord* won't record a mouse double-click as part of a macro. To do this, use Shift–Cursor Left immediately after inserting the equation from the glossary.

If you prefer to create the macro by editing it, the commands between the Sub Main and End Sub statements are

```
EditGlossary .Name = "AnyName",
 .Insert
CharLeft 1,1
EditObject
```

where AnyName is the name you've given to the glossary entry.

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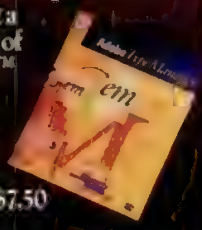

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CIRCLE 353 ON READER SERVICE CARD.

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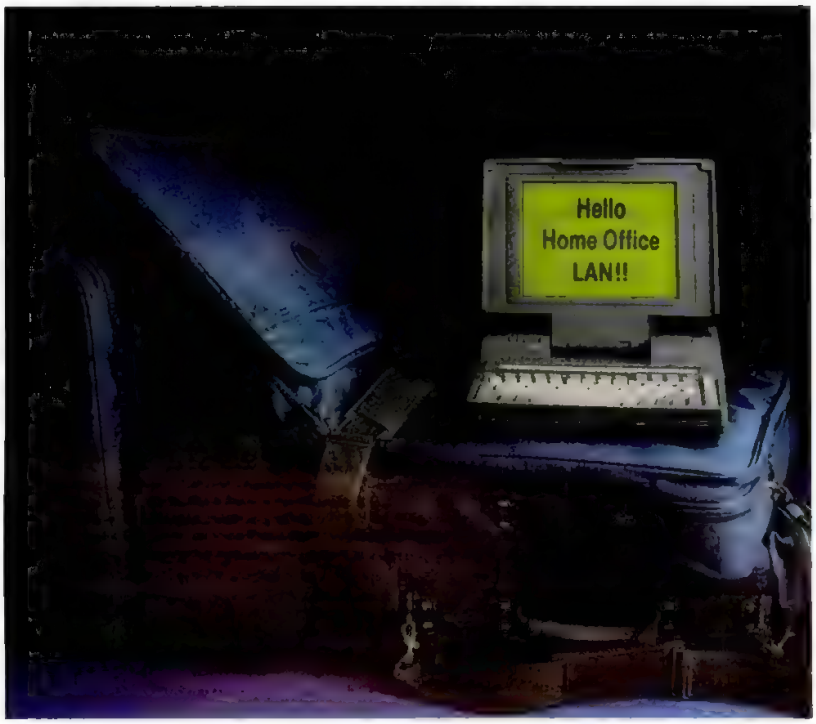

UDS

MOTOROLA

by
Frank J. Derfler, Jr.

Connectivity

THE TECHNICAL SUPPORT ALLIANCE

A vendor's representative recently used his company's membership in the Technical Support Alliance as a major marketing pitch. Is this for real?

John Dwyer
New York, New York

Good technical support is both critical and rare for networked systems. Inspired by Novell, the Technical Support Alliance (TSA) is a group of companies that exchange technical training and support. The objective is to avoid finger pointing among companies when customers face a problem. Generally, the idea seems successful. Several network managers have told me stories about companies in the TSA that initiated multicompany conference calls to solve network problems. I note that Shiva Corp. and Thomas-Conrad Corp. recently joined the over 100 companies now in the TSA. The TSA's roster includes names like Apple, Borland, Digital Equipment Corp., and Microsoft.

On the whole, membership in the TSA is most beneficial to small vendors. If you buy products from a company you haven't heard much about but it belongs to the TSA, you have some assurance of a serious attitude about support.

IMPERFECT CABLE—IN THE SHORT RUN

I'm trying to set up a simple LAN to connect computers at both ends of a rather large apartment, but wiring is expensive to install and unsightly. Unused coaxial cabling for cable television currently runs to each room, but I've been told that you can't substitute it for Ethernet-type coax. What about using it to fake twisted-pair wiring by splicing some unshielded twisted-pair onto both ends? I'd like something that would work with *LANtastic* or other low-end software.

George Cooper
via MCI Mail

- THE TECHNICAL SUPPORT ALLIANCE: The Technical Support Alliance helps prevent the finger pointing that arises in LAN support.
- IMPERFECT CABLE—IN THE SHORT RUN: You can get away with less-than-ideal cable over short distances.

Are you absolutely sure that the cable you see at both locations travels only between those spots? Usually a TV cable system uses separate runs from a common splitter or amplifier to each room. If you're sure that only a single piece of cable—connected to nothing else in your apartment—runs between those two appearances, I'd try using it for thin Ethernet.

You didn't specify exactly how long the run is, but even in a "rather large apartment," it should work. The cable impedance won't match that of the Ethernet card transceiver, and this will cause some distortion of the square waves, but it should function sufficiently at distances under a few hundred feet.

You can't splice into the cable and use it as 10BaseT twisted-pair, because typical twisted-pair systems use four conductors. You have only two: the braid and the center wire.

UPS OOPS!

While reading through the December 17, 1991, Connectivity column, I noticed an error concerning effective power as it relates to choosing a UPS for your PC. The rule of thumb presented in the article says to select a UPS with a volt-amp (VA) rating equal to your PC's power-supply rating in watts. This particular method, however, fails to account for the manner in which power supplies are rated, as well as their inefficiencies.

A typical supply wastes roughly 25 percent of its input power in the form of heat and fan noise, reducing its efficiency to about 75 percent. Also, the ratings for these devices refer to output rather than input power, so one marked 200 watts actually requires 200/.75 (75 percent efficiency), or 267 watts at its input.

The column gave the formula

```
UPSVA = (PCWATTS)/(power factor)
```

and listed a PC supply's power factor as 0.6, which, if we use the 267-watt figure from above, gives a result of

```
UPSVA = 267/.6 = 445VA
```

But 445VA is more than double the 200VA the article's estimation method would recommend. If you want a quick rule of thumb, choose your UPS VA to be at least twice the wattage rating of the PC power supply you intend it to support.

Wally Hersom
Irvine, California

Mr. Hersom's wattage-rating rule of thumb is absolutely correct. I applied the power factor incorrectly, and Mr. Hersom's math is much better than mine!

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay you $50 for any tip we print. Please submit your letter on-disk along with a printout. Mail your contribution to Connectivity, *PC Magazine,* One Park Avenue, New York, NY 10016. You may also contact Frank J. Derfler, Jr., via MCI Mail (MCI ID: 240-2931) or the PC Magazine LAN Labs fax machine (904-267-1578). We regret that we are unable to acknowledge submissions or answer letters individually. ■

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CIRCLE 026 ON READER SERVICE CARD

by
Jim Freund

PC MagNet

THE SOFTWARE AND UTILITIES LIBRARY

ZiffNet's Software and Utilities Library (SoftLib) is a primary source for file seekers, as it offers a single repository for the most up-to-date utilities to come on-line. It also features easy-to-use menus offering multiple search-narrowing criteria to help you search its more than 5,500 files.

After logging on to ZiffNet, select Software and Utilities Library from the main menu, download a *PC Magazine* utility from the PC MagNet menu, or type GO SOFTLIB at any ! prompt. You will be presented with the following menu:

```
ZiffNet Library            SOFTLIB

 1 Download the Latest Files
 2 Essential Software Kits
 3 Search for a Utility
 4 Download a Utility
 5 Public Brand Software Forum
 6 Demos Showcase
 7 Learn about Shareware
 8 About the Library
 9 Instructions for Searching
10 Uploading submissions
```

Let's examine highlights of this menu:

- **Download the Latest Files** enables you to choose from the files featured in the current issues of Ziff-Davis Publishing Co.'s PC-related magazines, as well as the monthly Shareware Top Ten List from Public Brand Software. Typing GO LATEST from anywhere in ZiffNet works as a direct shortcut to this menu.
- **Essential Software Kits** (GO KITS) are collections of shareware and free software pertaining to a particular task, such as Virus Busters or Windows Tune-up Kits. As this section is continually updated, you may read about the contents of each offering in-depth or download just a portion of the kits.
- **Search for a Utility** allows you to browse through titles using criteria such as the utility type, keywords, the magazine of origin, the filename, the date, or the author. When you have narrowed the search to under 50 *hits* (files that meet your search criteria), the filenames will be displayed. Selecting a name will give you a full description of the file and an opportunity to download it. Otherwise, you will be given an option to narrow your selection set further.

> ■ THE SOFTWARE AND UTILITIES LIBRARY: Thousands of useful files are available to you at little or no cost.

- **Download a Utility** is the fastest way to get a file whose name you already know. You only get one prompt here: "Enter filename." A useful tip is to enter just the beginning portion of the filename, so you can get a list of all the files associated with a particular utility.
- The **Public Brand Software Forum** was extensively described in the March 17, 1992, PC MagNet column.
- You can download demonstration versions of a wide range of commercial software from **Demos Showcase**. There are some complete working versions of packages here, too.
- You will find text files with useful information in **Learn about Shareware,** which serves as a general explanation of your responsibilities when a file is shareware (try before you buy), free, banner (which is free but copyrighted and often displays an advertisement), or public-domain. While there are no charges aside from the connect time associated with downloading files from SoftLib (or anywhere else on ZiffNet for that matter), the software itself is not necessarily free, or in some instances (as with *PC Magazine* utilities) may not be copied for any commercial purpose. Many files will clue you in to what cost or restrictions apply.
- **Instructions for Searching** consists of in-depth tips on how to establish your selection sets (search criteria).
- **Uploading submissions** tells you how to go about submitting a file for the Software and Utilities Library or PC MagNet. The process is straightforward: Navigate over to PC MagNet's Utilities/Tips Forum (type GO UTILFORUM) and upload it to Library 0, "New Uploads." Of course, you must have full rights to any software or article you submit. Our sibling publications' forums may be accessed under the Ziff Magazines Online menu option.

Downloading works somewhat differently in SoftLib than in the PC MagNet forums. To begin with, the operating system under which ZiffNet's forums operate limits filenames to six characters (and three for the extension). SoftLib is in a special database that permits us to list the more-familiar eight (and three) characters used by DOS.

Therefore, a search for a filename like JOURNAL.ZIP in SoftLib may yield a hit with that filename in SoftLib but not in Utilities/Tips, where it appears as JOURNA.ZIP. One tip for searches in SoftLib is to type in as few characters as possible and never type an extension. Another way to get the file you want is to Search by keyboard, using either filename (without an extension).

At this point, you will see a menu asking you to select a transfer protocol. Select one that your telecommunications software supports (we recommend CompuServe B+ as the most efficient) and commence the download by pressing the Enter key. It is important to be familiar with the features of your communications software. If you do not see a selection menu on-line, you may have made a permanent selection (perhaps with auto-navigational software like *TAPCIS*) in your user profile. Go to Account Maintenance to make a change if necessary.

Post any questions you may have in PC MagNet's UTILFORUM message section (GO UTILFORUM); we will be glad to help. ■

by
Barry Simon

Utilities

Improve Program Launching in Windows With MC.EXE

■ A utility that puts file-management and program-launching functions in the same window finally makes it easy to run programs in Windows.

Although the Windows Program Manager is a vast improvement over the old MS-DOS Executive, the thriving market for replacements such as *The Norton Desktop for Windows* and *hDC Power Launcher* shows that there's more than one way to launch a program. My own approach to improving on the Program Manager is called MC (Master of Ceremonies), and it is this issue's free utility.

MC is based on the premise that there are three ways you'll typically want to start programs from Microsoft Windows: First, you'll often want to pick an application from within a preset program group. This is one of the Program Manager's main features, of course, but when you've built up many groups, juggling their windows is more of a nuisance than the grouping is worth. MC forgoes the pretty icons in order to give you quick access to a large number of programs without so much clicking and dragging. And since you've probably invested some effort already in setting up Program Manager groups, MC lets you import your existing program sets intact.

Second, you'll sometimes want to locate a file by browsing a directory tree and then launch the program from there. You can do this with the File Manager, but the separation of the File Manager from the Program Manager is awkward. Windows 3.1 addresses this problem by adding a Browse button to the Program Manager's File/Run command, but even with that, it still takes several keystrokes to do the job. With MC, the drive/directory/file boxes are visible and available right on the main screen.

Third, you'll sometimes want to enter a command directly, as you would by using the Program Manager's File/Run option. But File/Run suffers from the same defect that afflicted the DOS command line until DOS 5.0's DOSKEY came along: It has no memory. You can't just reissue a command you used earlier. So MC's third design goal was to enhance the Run command with a list of your most recent commands, which you can recall, reissue, and even edit. The history list includes not only programs that you launched from the command line, but programs you started from the directory tree as well.

In creating MC, my goal was not only to produce a better Program Manager but to implement my design in Microsoft Visual Basic, thus illustrating the usefulness of that environment for making Windows utilities. [*Visual Basic is also the topic of this issue's Lab Notes.—Ed.*] Indeed, the sample file launcher presented in the Visual Basic manual was the starting point for MC itself.

MC.EXE and its help file, MC.HLP, are combined in a file called MC.ZIP, which you can download from PC MagNet, as explained in the sidebar "Downloading Utilities." You can also download its source code, which is contained in MCSCR.ZIP. MCTXT.ZIP contains an ASCII version of the code, but it requires Visual Basic if you want to do more than look at it. The Visual Basic file VBRUN100.DLL, which you need to run MC (and which must be kept in the same directory with the utility, in the SYSTEM subdirectory of your Windows directory, or in the Windows directory itself), is compressed in the downloadable file VBRUN.ZIP. If you don't have a copy of Phil Katz's shareware program PKUNZIP, you'll need to download PCUNZP.EXE, the utility presented in this column in our March 31, 1992, issue; either one will break out and decompress the .ZIP files posted on PC MagNet.

If you don't have a modem, you can get this utility on-disk by sending a postcard with your name and address to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016. No phone calls, please.

After copying MC.EXE and VBRUN100.DLL to your hard disk, you can install the program and locate its icon in the Program Manager with the File New command. Note that MC is intended as a program launcher. Because of a limitation of Visual Basic, you can't use MC as your primary shell loaded via a SHELL statement in your SYSTEM.INI file. In discussing how to run MC, I'll start by assuming that you're using a mouse. If you want to use the keyboard instead, refer to the "Keyboard Usage" section below.

ADDING PROGRAM MANAGER GROUPS

The main MC screen is shown in Figure 1. The first time you start MC, the list shown in the left column will be blank and the title at the top of the window will say MC. Notice that there are *no* menus in the screen. Button bars and other shortcuts that avoid time-wasting menus are becoming so popular that I decided to push this approach to the logical extreme

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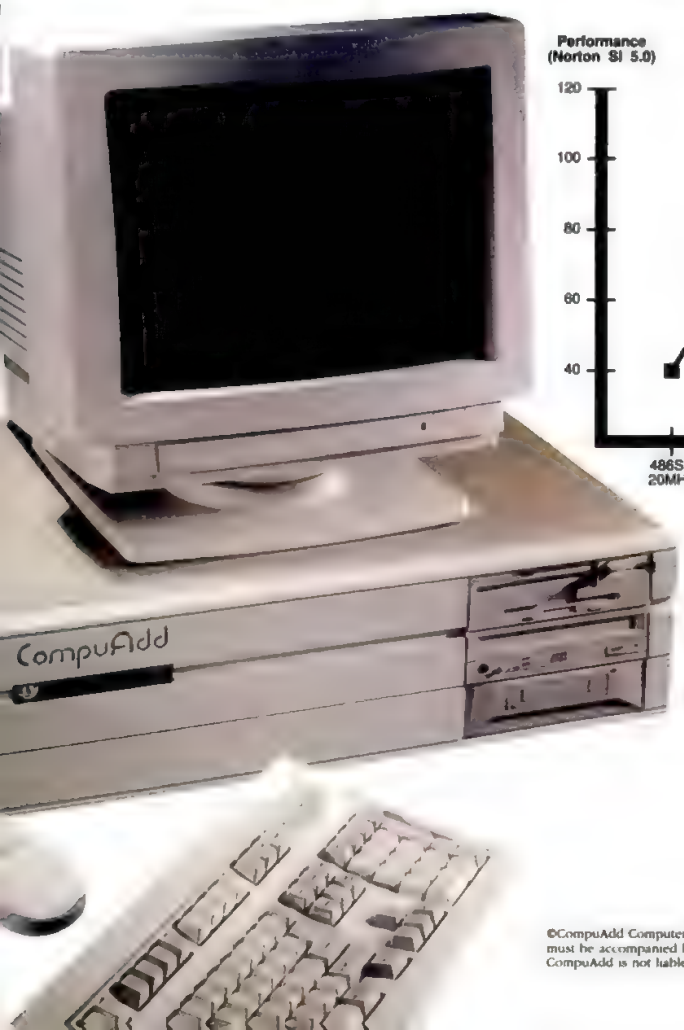

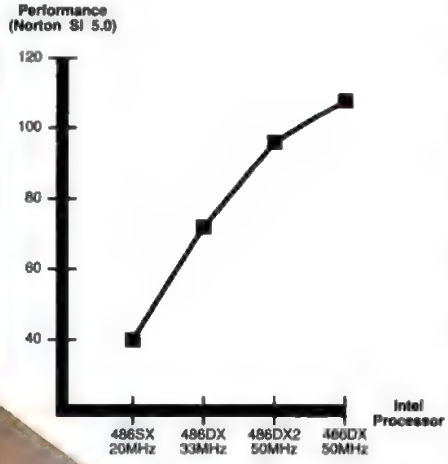

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Set your communications software to 300, 1,200, or 2,400 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex.

Dial the local number. When you connect, type Ctrl-C. At the HOST NAME prompt, type CIS. At the USER ID prompt, type 177000,5000. At the PASSWORD prompt, type PC*MAGNET. At the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

Register your name and enter your MasterCard, Visa, or American Express card number. (If you'd like to have your company billed instead, call CompuServe at 800-848-8990.)

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Ziffnet membership costs $2.50 a month, which includes unlimited access free of connect charges to several on-line services. See page 10 for details. CompuServe members can join by entering GO PCMAG at any CompuServe "!" prompt. CompuServe can be reached at 800-848-8990. Outside the United States, call 614-457-8650.

PC MagNet costs $12.80 an hour for 1,200- or 2,400-bps service, or $6.30 an hour for 300-bps service. Billing is based on 1-minute increments.

These programs can be copied but are copyrighted. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is prohibited. ■

of providing button shortcuts for everything in MC.

The first thing you'll want to do is to add your Program Manager groups to MC's group list. Before doing so, it's a good idea to hit the Add button in the second column and create a (temporarily empty) group called Main Programs, which MC will thereafter display when you load it. You'll probably want to customize the contents of the Main Programs group rather than simply bring up the first of your Program Manager groups by default each time.

To add your existing Program Manager groups, hit the Configure button. Ignore the busy screen (shown in Figure 2) for the moment and press the button labeled Load Program Manager Groups. That will bring up a third dialog box, shown in Figure 3, with a list of your current Program Manager groups.

Unless you have a special reason for not adding all your established groupings to MC's own group listing, just hit the Process Selected Groups button. If you have more than 7 groups, or if any group has more than 16 programs in it, a message will inform you that some parameters need to be increased and it will ask permission to save the changed parameters in the MC.INI file. If that message appears, answer yes.

Either way, MC will then process your Program Manager groups by adding them to its own group list, and you will be taken back to MC's configure screen. Hitting OK there will return you to the main screen. If you press the arrow next to the word "Group" in the leftmost column, you'll get a drop-down list of all your groups, starting with the (empty) Main Programs group that you added at the start. If you choose one of the Program Manager groups, the list below the drop-down box will display the names of the programs in that group.

LAUNCH BASICS

The simplest way to launch a program is to double-click on it from either the group lists or the file list. To see how this works, just pick a small Windows application from those lists (for example, CLOCK.EXE from the Accessories group) and double-click on it. The program will launch in normal size.

Instead of double-clicking, you can click only once and then use the buttons in the Run box in the lower-left-hand corner of the screen. As the button names indicate, the program can be launched in normal mode, as a full-screen application, or as an icon, depending on which button you press. (If you're at your machine, be sure to close the multiple copies of CLOCK that you've now opened!)

Now notice the Minimize MC check box to the right of the Run box. If you click on it before launching, MC will automatically be minimized when you launch an application. If you want, you can tell MC in its configure screen always to recheck that box after a launch so the default will be to minimize before launching.

Next, look at the History drop-down box. It will be blank the first time you load MC, but it won't be after you've made some practice launches. If you click on the History arrow you'll get a list of all the programs you've recently started from MC. By default, the history list keeps the last 20 commands that were issued, but you can adjust this value in the Configure dialog box.

You can also type commands into the History box. For example, entering

```
NOTEPAD C:\AUTOEXEC.BAT
```

will call that file into Notepad. Isn't that easier than clicking around to find the root directory? If you just type in

```
C:\CONFIG.SYS
```

and hit Enter, you'll get a message offering to load that file into Notepad. Whenever you try to run a file without an associated extension, MC will offer to load it into Notepad. It will also offer to run Notepad if you configure it to display "All Files" in the file display and double-click on a file that has an unassociated extension.

MC recognizes one special command word when you type in a command. CDD is interpreted as "change drive and directory." Thus, if you enter

```
CDD D:\PROGRAMS\EXCEL
```

MC will change the underlying DOS drive

Figure 1: Replacing space-consuming icons and windows with filenames enables MC to achieve greater program-loading flexibility.

to D: and the directory to \PROGRAMS \EXCEL. The current directory isn't usually important to MC, since MC changes it in response to a file launch or group launch. But since you might want to change the directory before running a program from the command line, CDD has been provided.

There are four buttons to the right of the Group list box that can affect its contents:

- ADD can be used to add a new group or add an item based on either the history list or the file list. Which is used depends on which you clicked last. So to add a file, click on it once (not twice, which would launch it) and then click on the Add button.
- DELETE will delete an item or an entire group, depending on which radio button you push in the dialog box.
- RENAME lets you change the name that appears in the Group pull-down or in the item list. Click on the item you want to rename and then on this button.
- PARAMS displays the drive/directory used by an item in the group and lets you add or edit parameters passed to a program you enter on the command line.

THE FILE LAUNCH LIST

Now that you understand how the groups and the history list work, focus on the three objects in the middle of the main screen, to the right of those four buttons. (Again, see Figure 1.) Here you'll find an untitled file list, a directory list (indicated with file folders), and a drop-down list of disk names. You might intuitively feel that these are placed in the wrong order—that the drive list belongs on the top left and that the file list should be to the right of the directory list. I selected the actual placement to conform to the new Common Dialog arrangement introduced with Windows 3.1 and used already in many applications introduced after September 1991. This is what you'll have to get accustomed to!

The lists are linked together, so changing the directory in the directory list will change the executables displayed in the file list. (Data files are not shown in the file list unless the All Files box in the configure screen has been checked.) Double-clicking on a program will launch it in normal size. Alternatively, clicking once and hitting one of the Run box buttons will launch the chosen application in maximized or minimized form. As you single-click on an item in the file list, the caption in the Run box changes to indicate exactly what MC will launch. Files launched from the file list then appear in the history list.

MAIN-SCREEN MISCELLANY

Finally, on the main screen, look at the rightmost column. The Save button will save your groups, items, and history to MC.INI. If you started with a lot of Program Manager groups and items, your first save could take more than a few moments. After that, however, only the History list and changed groups will normally be saved, so the save will take less time. If you try to exit MC with unsaved changes or an unsaved history, you'll be warned and given a chance to save to MC.INI.

Skip the Configure button for the moment and look at the radio buttons in the box marked Caption. These affect the title of the main MC window. Figure 1 actually shows what happens when you pick Date Time. In this configuration, MC will act as a clock/date reminder even when minimized at the bottom of your screen. The last three buttons (About, Help, and Exit) are self-explanatory. Note that because MC changes to the directory of a program you wish to launch as the program is run, MC.HLP must be on your path or in the Windows directory.

KEYBOARD USAGE

MC is really a huge dialog box and, like most dialog boxes, it's best driven with a mouse. If you don't like mice, or if you like to use keyboard shortcuts, MC supports keyboard operations, too. First, Tab

Figure 2: Customizing default configuration options is only a click away from the main screen.

Figure 3: This screen, which is accessible from the configuration screen, processes the Program Manager's existing groups and adds them to MC's own group list.

and Shift-Tab will switch the input focus (indicated by a dotted-line box) forward and backward around the screen, respectively. So, for example, you could launch a file by tabbing to the file list and using the Arrow keys and Enter. The tabbing order was chosen to prioritize the items I expect you'll use most heavily rather than to reflect the physical arrangement of the items that appear on the screen.

Pressing Alt together with the underscored letter on objects on the MC screen will immediately execute the corresponding command. For example, Alt-Y will change the focus to the history list. And as with any Windows-standard drop-down list, Alt-Down Arrow will open the list.

Three lists don't have visible names but still have accelerator keys. Alt-V, Alt-D, and Alt-F take you to the driVe, Directory, and File lists, respectively. Within the lists, the Up Arrow and Down Arrow keys take you from one item to the next. Pressing F1 will invoke Help from anywhere in the program.

THE CONFIGURE SCREEN

Hitting the Configure button pops up the screen shown in Figure 2, from which you can change many of the MC defaults. Basically, this is a set-and-forget screen, which you've already used to import your Program Manager groups. The box on the left, which is labeled Date/Time Options, controls the format that MC uses to display the time or the date and time. If you change one of those items, a box like the one shown in Figure 4 will pop up, showing you how the date and time will look after your modification.

The Launch Choices box determines two things. The Minimize MC When App Runs check box works with the Minimize MC box on the main screen. Whether MC actually minimizes itself is determined entirely by whether the check box on the *main* screen is checked or not. The box on this secondary form simply sets a default. If you check this box, then each time you launch an application from MC, the Minimize MC box will be checked for the next launch. Thus, if you normally want to minimize MC upon launch, you should check this box on the configure screen. If you decide that you'd like to override the default one particular time, just uncheck the Minimize MC box on the main screen before that specific launch.

The DoubleClick Option allows you to set which of the three options is used when an item is double-clicked. The Files Displayed dialog box determines which extensions are displayed in the file list. Checking the All Files box results in the listing of data files as well as executables. The Associations check box refers to the extensions singled out in the [Extensions] section of WIN.INI. Note that because of a limitation of Visual Basic, if you have more than 25 items in that list, only the first 25 are displayed.

Finally, there are drop-down lists for setting the maximum number of groups and items, and for setting how many items are kept in the history list. These values might be better handled with a spin control, which would show numbers with little arrows next to them and let you increase or decrease them one at a time. But while third-party spin controls are available for Visual Basic, I decided to limit this project to what can be done to the drop-down lists with the unadorned version of Visual Basic.

VISUAL BASIC OVERVIEW

Having described how MC works, let's turn to some of its programming aspects. MC was written in Visual Basic (VB), a visual programming environment from Microsoft. The source code is available by downloading MCSCR.ZIP from PC MagNet and unzipping it. The source code consists of a Make file and a set of binary files that only VB can read. In addition, in MCTXT.ZIP you'll find a file called MC.TXT, which contains the code for MC in ASCII format. This file tells you something about the program, but with-

Figure 4: Before you select a time or date and time display format for MC's main screen and icon, the program lets you see how it will look.

MANAGE TO

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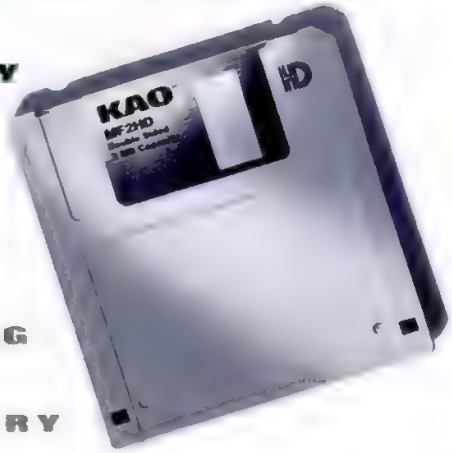

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CIRCLE 139 ON READER SERVICE CARD

PC MAGAZINE UTILITIES UPDATES

As with all good software, the programs presented in *PC Magazine* are periodically upgraded and improved. You can get the modified versions by downloading them from PC MagNet. Here's a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities. If the filename listed here is longer than six letters, search on the first six letters, using the same extension.

ANSI.COM, Version 1.3
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BCOPY, Version 1.2
Benchmark Series, Version 6.0a (BEN60A.EXE)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.5
CMDEDIT.EXE, Version 2.8
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PANDORA.COM, Version 2.4
PCACCESS.EXE, Version 1.1
PCMANAGE.EXE, Version 1.1
RN.COM, Version 3.0
SCHEDULE.COM, Version 1.1
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1
ZCOPY.COM, Version 1.4

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out the certain items that you can view only in VB, it is only part of the story.

Because the VB manual doesn't explain how to do it, I should mention how the MC.TXT file was created. To make this file, I had to load the code in VB for each form and *.BAS file and choose the Save Text menu item. Then I called up my favorite editor and imported each of the individual ASCII files.

Except for the message boxes (which use a built-in facility of Windows itself), each window displayed by MC is designed as a *form*. In VB this term simply denotes a file that contains both visual elements and code that show up in a window or dialog box. The VB environment provides a palette of controls—buttons, check boxes, and so on—that you draw directly on the forms.

VB goes beyond being a mere dialog-box editor, which would simply produce code to display a form. The first advance VB makes is that each control, as well as the form itself, has a set of properties that you can set during the design phase and can change under programming control. Thus, to take a simple example, the caption on the launch button group changes color when you choose an item in the file list. This is accomplished by defining a suitable constant, red (which you get by choosing the color from a dialog box), and placing the code

```
Frame1.ForeColor = Red
```

in the procedure that is called when you click on an item.

A second crucial advantage of VB is that it recognizes that Windows programming is basically writing event handlers. Each control has a set of events to which it can react, and you can write code for those events. For example, the heart of the MC utility is a routine called Button_Click, which is associated to Form1, the main program window. VB lets you place controls of the same type into arrays, and I placed the 12 buttons on that form into a single button array with index 0,...,11. That index is passed to the Button_Click routine as a parameter. A CASE statement handles the effect of the different buttons.

Typical of the code of handlers a programmer needs is the Dir1_Change() procedure shown below.

```
Sub Dir1_Change ()
 File1.Path = Dir1.Path
 File1.SetFocus
 If File1.ListCount Then
   File1.ListIndex = 0
 Else
   Frame1.Caption = "Run"
   Frame1.ForeColor = Black
 End If
End Sub
```

In this short code fragment three controls are involved: the directory list box (Dir1), the file list box (File1), and the frame around the Normal/Maximized/Minimized buttons (Frame1). The procedure's name tells you that the procedure is called whenever the user changes the directory in the directory list box. The first line takes a property of the file box—namely, which directory is displayed—and sets it equal to a property of the directory list.

The next line makes use of the BASIC convention that 0 is False and all other integers are True to test whether any files are actually displayed in the File List box. If not, the Run caption on Frame 2 is changed to black, which denotes that that item is inactive. Otherwise, the first file is highlighted.

The VB environment makes good use of drop-down lists. The properties of any form or control that you can set when designing are in a drop-down list that changes as you click the control. Values are also set with drop-down lists. The code editor for a form has two lists: one of the controls and the other of events associated with each control. VB also lets you add general code either to a form or to separate .BAS files.

VB'S LIMITATIONS

The VB environment is a pleasure to use, and it is hard to imagine going back to any environment that doesn't embody the same visual paradigm. The compiler in this early version, however, contains a number of quirks and limitations that I found frustrating and that you may have to get used to or work around.

At the top of my list is the way VB handles variable names. Though it follows an old BASIC tradition in this respect, only an outmoded design would have a misspelled variable produce a bug rather than a compile error. During my development of MC, several strange bugs were produced this way. And while this program was simple enough that I could track them down fairly easily, I wouldn't

have been able to do so in a more complicated project. VB should have a mode that requires previous declaration of variables and even does tight type checking.

VB also imposes limitations on user-defined types. Fundamental to MC is a record type that the code calls *program*. It consists of four strings: a drive, a path, a filename, and a parameter. An *item* consists of a name and a program. I would have loved to define a type called *group* as an array of items, but, alas, types in VB cannot include arrays. This forced me to use a two-dimensional array for the list of groups, making the code less readable and forcing some unnecessarily nested loops.

I found it an inconvenience not to have a pointer variable, a word variable, or a byte variable. The code for reading Program Manager groups (discussed below) uses the fact that the group files employ a word as a pointer into the file structure. VB has no words, and I found that using integers didn't work when I tried a file over 32K in size. So I had to use long integers. These problems would be easily solved in Turbo Pascal for Windows simply by typecasting.

The VB compiler does not always do a good job of pinpointing errors. At one point in MC's development I made the mistake of defining a function with a user-defined type as a parameter and then passing that parameter `ByVal` (a BASIC keyword that tells the compiler to pass the parameter by value rather than by reference). It turns out that in VB, `ByVal` can be used only with built-in types. But no error message appeared to point out my illegal use of the keyword when the compiler reached that function. Rather, when the function was called later, I got the error message "Type Mismatch" and spent some time trying to figure out why what seemed like a proper type was being rejected.

Another area in which VB could be improved is its debug capabilities. You can put in absolute breakpoints or break by hand, but there are no conditional breakpoints. Once you break, there is a window in which you can type in commands (including print commands) to examine variables, but there is no automated watch, and you can't examine a user type except one component at a time. These are hardly fatal flaws, however; I've just been spoiled by Borland's compilers and debuggers.

Next on my list of complaints is the mismatch of VB variables, coupled with poor type checking, when making Windows API calls. At one point I passed a parameter as "&0" instead of "0&". I wanted a null pointer (long), but VB interpreted &0 as "octal"! Does anyone still use octal? In this case, the bad pass to the Windows kernel caused not just a UAE, but a spectacular one that wiped out my WIN.INI! That'll teach me.

Version 1.0 imposes a number of limitations on the basic VB controls: Buttons can't have multiline titles, the filespec pattern is limited to 128 characters (which forces MC to ignore some of your file associations if you have more than 25), and the program lacks spin controls. Microsoft's VB Professional Toolkit and many third-party custom control packages address these issues.

While styles differ, I wish VB didn't protect me quite so much. As you'll see, the method that MC needs to use to check whether it is loaded is a kludge that won't work if you change the name of the .EXE file—precisely because VB protects us too much!

A more specialized complaint is the lack of formwide or programwide keyboard handlers, except to call menu items. To have F1 invoke help, you have to include code in the keyboard handlers for each individual control—more than 35 of them in MC's case.

A final annoyance is the lack of a line-break character to allow breaking a long line of code—a feature that even Word BASIC possesses.

Despite all these criticisms, the overall VB paradigm is so attractive that I can't imagine writing small Windows utilities in any other currently available environment.

USING API CALLS

While VB protects the programmer from a lot of the Windows nitty-gritty, there are services provided by the Windows API that VB doesn't provide directly. Thus, like MC, you may need to make some Windows API calls from a VB program. In the somewhat arcane syntax required by VB, both MC.BAS and the code for Form1 use declarations such as the one shown below:

```
Declare Function GetFreeSpace Lib
 "Kernel" (ByVal wFlags As
 Integer) As Long
```

MC uses the following API calls:

- MC.INI is accessed with GetPrivateProfileString and WritePrivateProfileString. Doing this is the "proper" way for a Windows program to access .INI files, but long save/load times are the result. It might have been wiser to put some of the .INI information in a binary file that could be manipulated directly.
- To access the [Extensions] section of WIN.INI, the corresponding GetProfileString is needed.
- MC gets the names of the Program Manager groups from PROGMAN.INI using GetPrivateProfileString.
- The About box displays free memory using GetFreeSpace.
- Help is called with the API call WinHelp.
- The check for multiple loading of MC uses GetModuleHandle and GetModuleUsage.

The check for multiple loading is a little tricky, and there is no reason that it needs to be. Every program that Windows loads is passed a parameter that includes a handle to information about previous instances of the program. VB protects you from that information, however, and there appears to be no way to get it. So in the Form_Load code for Form1 I had to use

```
hnd% = GetModuleHandle("MC.EXE")
count% = GetModuleUsage(hnd%)
If count% > 1 Then
 Display message box and take
 action
End If
```

Alas, if you rename MC.EXE, it won't be able to find previous instances of itself because I had to use this method!

A UAE-PRODUCING BUG IN VB

Another kludge in MC's code concerns Unrecoverable Application Errors (UAEs) that originally occurred if you tried to exit Windows without explicitly closing MC first. This is a problem caused by some known bugs in VB. Users are willing to put up with load time but are less willing to wait once the program loads. Accordingly, MC preloads the Configure MC window into memory when MC loads, but it shows the window only when the Configure button is pressed.

VB programs do not automatically remove all child windows when the program ends, so the original MC beta version had code in the Form1_close proce-

dure that explicitly unloaded Form4, the configure screen. This is what caused the UAE; you cannot unload a second form from the close code of a first form if the process is taking place during an exit from Windows.

The fix was in essence for Form1 to send a message to Form4 telling it to unload. Explicitly, I placed a hidden timer control on Form4. The code to execute when the timer is done counting tells Form4 to unload itself. The timer is initially set as disabled. The Form1_close code enables the timer and sets it to 1 millisecond. The timer is on Form4 and has no problem issuing the unload command for its form.

PROGRAM MANAGER GROUPS

Finally, I should take the time to discuss some aspects of the code used to read in the information stored in Program Manager .GRP files. The key procedures are in PMAN.BAS under the names GroupInfo and ProcessPGroup. The names of the group files are stored in ASCII format in PROGMAN.INI and can be obtained with the Windows API GetPrivateProfileString call.

Once the filenames of these .GRP files are returned, they need to be analyzed. The .GRP files were undocumented under Windows 3.0, but fortunately they have been documented in the Windows 3.1 SDK. The group file includes icon image information, but for our purposes the critical aspects of its structure are that names are stored in ASCIIZ strings (that is, null-terminated strings) and that single word pointers are used to access the start of these strings.

The .GRP file starts with a header. At offset 16h in the file is a pointer to the string that gives the group its name. At offset 20h is the number of slots that are reserved for items in the group. In all the .GRP files I was able to examine, the number of slots was a multiple of 16. Immediately following this, starting at offset 22h, is a list of words, one for each slot. Unused slots have zeros at that location, and used slots have a word there that gives the offset in the file of an `itemdata` structure.

The `itemdata` structure includes two pointers of interest to MC. At offset 12h is a pointer to the item name, and at offset 14h, a pointer to the program filename.

Given these structures, the coding for handling Program Manager groups in MC is fairly straightforward. When you call up the dialog box, MC reads PROGMAN .INI, using GetPrivateProfileString to find out the names of the .GRP files. It then reads those files to get the group names and the number of items to display.

When it comes time to process the groups, MC reads the group files once again to get the full commands associated with items in the group file, which it parses into drive, directory, filename, and parameters.

SUMMARY

As MC illustrates, for a small to medium-size Windows utility, VB is a pleasant development environment. The limitations of Version 1.0 are not fatal, and where necessary, you can make calls to the Windows API. The easy design mode and built-in event handlers make programming a delight.

Barry Simon is a contributing editor to PC Magazine. ■

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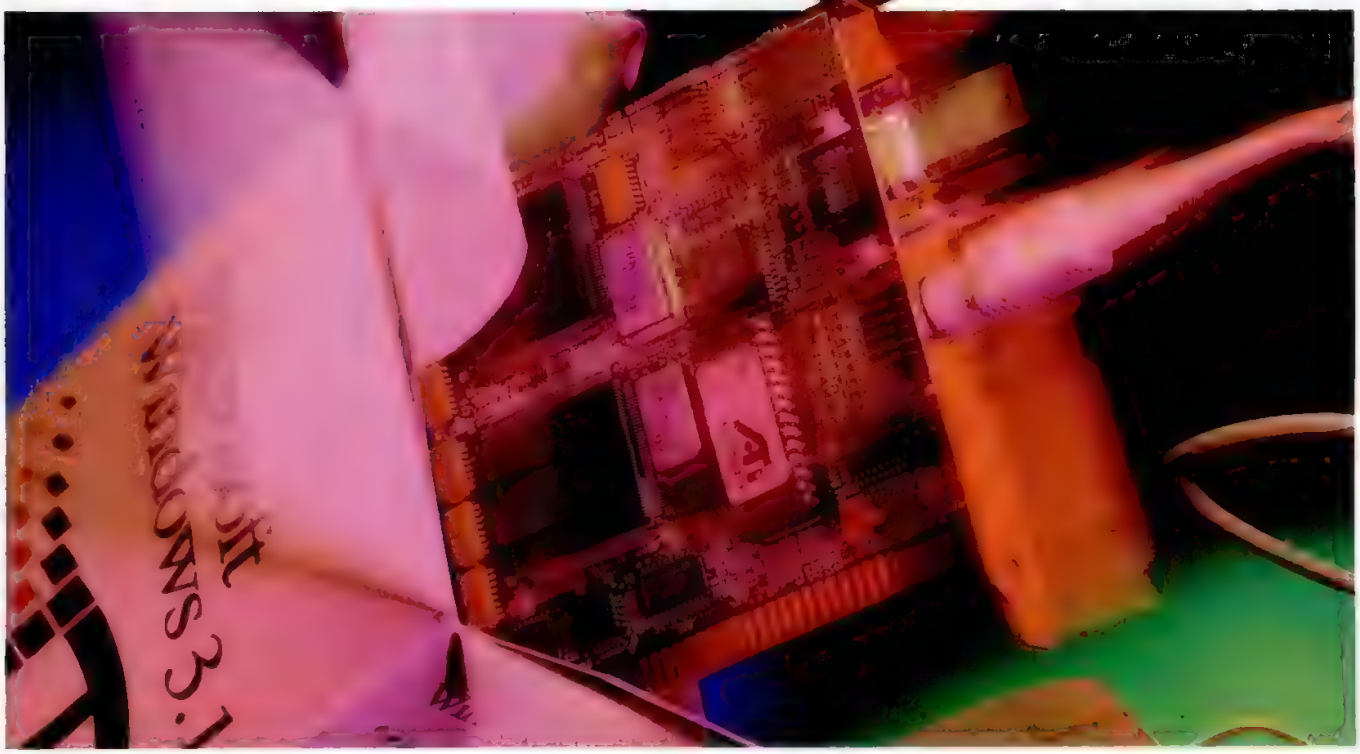

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CIRCLE 337 ON READER SERVICE CARD

by
Jay Munro

Lab Notes

Writing DLLs for Windows Using Visual Basic, Part 1

■ Here's a step-by-step approach to writing your own DLLs, complete with a full-scale model and all its files, to get you started using VB.

Want to write a Microsoft Windows app? Then consider using Microsoft Visual Basic, the most important BASIC development product since QuickBASIC. Visual Basic gives you the same ease of use and familiar BASIC language, and just as external libraries enhanced the power of QuickBASIC, you can expand the potential of Visual Basic with dynamic link libraries (DLLs). This column will show you how.

Dynamic link libraries lie at the heart of Windows. DLLs are special libraries that load into memory only once, at runtime, and can thereafter be used by many programs. In contrast to the traditional static libraries, which add code to the executable at link time, a DLL links with a program at runtime. Not only can the DLL be accessed by applications other than the one that originally loaded it, but the DLL can itself call external functions, such as the routines in the Windows Applications Program Interface (API).

The Windows API contains a rich set of system, user interface, and graphics functions, which are contained in the KERNEL.EXE, USER.EXE, and GDI.EXE files. Further, the COMM.DRV and SOUND.DRV files provide communications and basic sound support. In fact, the entire system of video, keyboard, mouse, and font support for Windows is done with DLLs. Visual Basic itself is based on a DLL called VBRUN100.DLL.

Writing a simple DLL is really not much more complicated than creating a static link library, just different. In this two-part Lab Notes, I'll show you how to build a small DLL (LABNOTES.DLL) and how you can use it in your own Visual Basic programs. In Part 2, we'll look inside our DLL and see how it supplies some low-level QuickBASIC functions that were omitted in Visual Basic.

BUILDING A DYNAMIC LINK LIBRARY

Before the advent of Visual Basic provided another alternative, the C language and the Windows Software Development Kit (SDK)—or, more recently, Borland's C++ and Turbo Pascal for Windows—have been the basic tools for writing Windows applications and libraries. What is not so widely known is that it is also possible to write utility DLLs in assembly language. The advantage of writing DLLs in assembly language is that you don't have to sacrifice small executable size in order to add low-level functions.

The Windows Software Development Kit provides programmers with four main things: resource utilities, include or header files and libraries, debugging utilities, and documentation. Resources are graphical entities such as bitmaps, fonts, icons, and dialog boxes, and the SDK provides utilities to create and edit them. The Resource Compiler combines these resources into the executable file in a format that Windows can use. To facilitate calling the Windows API, the SDK also provides include files and libraries that can be used with either C or assembler code.

For tracking down the inevitable bugs, the SDK comes with the debugging utility CodeView for Windows (CVW). The SDK also includes Heap Walker (a memory-viewing utility), Spy (a message-viewing utility), and several other utilities.

Finally, the full SDK documentation consists of a four-volume reference set, including a volume on tools, a users' manual, and two API reference volumes.

My intention here is to get you started writing DLLs with a minimal amount of effort, even if you do not have the Windows SDK. LABNOTES.DLL, the model presented here, does not contain resources, and it can be created without the SDK by using MASM, Link, and PCMark (a DLL marking utility I wrote for this column). The source code for all the files given here can be downloaded from PC MagNet as LABNOT.ZIP. If you're not already a PCMagNet user, see the downloading instructions in the sidebar "MC by Modem" in this issue's Utilities column. If you don't have a modem, send a postcard with your name and address to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016. (No phone calls please.) I also recommend that you get the *Windows Reference Manual*, available by itself from most good bookstores.

THE ENTRY MODULE

Every DLL must have an entry point, just as an executable file does. The entry point for LABNOTES.DLL is provided by LIBENTRY.ASM, a simple assembly procedure that is called by Windows when the DLL is first loaded. The assembler directive `END [startlabel]` in LibEntry tells Windows that this module is the main starting point for the library. Obviously, then, as with QuickBASIC libraries, you should not use this

directive in any other modules.

The LibEntry procedure is called only once, so nothing in its code should be required by the DLL after initialization. Usually, the first thing LibEntry does is to initialize the local memory area, or heap. Windows tells LibEntry that the heap needs initialization by putting the amount of memory needed in the CX register. Thus, if CX is nonzero, the LibEntry routine calls the Windows API routine LocalInit to initialize the local memory. It is not necessary to initialize all the local memory you need at start-up, since Windows will allocate more if needed, up to 64K per DLL. When the local heap is initialized, it also must be unlocked with a call to the UnlockSegment function. Left alone, LocalInit leaves the block locked, which would prevent it from being used later.

If the DLL is completely written in assembly language and it uses the DLL's data segment (DGroup), the LibEntry module must also reserve 16 bytes of DGroup for Windows' use. This 16-byte sacrifice is not unique to assembler; it's just that the C and Pascal compilers reserve the space automatically. The LibEntry procedure is called by Windows with four parameters set up in the registers shown below:

```
DI      ; handle of module instance
          set by Windows
DS      ; library data segment set
          by Windows
CX      ; Local heap size set in
          the.DEF file
ES:SI ; command line pointer
```

Some compilers put the entry code into the DLL's main module invisibly. If a separate module is used, it must be written in assembly language, as Windows calls the procedure with the parameters in registers. The SDK provides the LibEntry module as an object module to be used specifically with C programs. This enables C programmers to write code without any knowledge of assembler. The LibEntry procedure calls a specific module, LibMain, which the programmer writes in C.

If you're writing in C, then, the entry point and initialization routines must be named LibEntry and LibMain. Assembly language DLLs can use any name. If you write your own LibEntry module, all the initialization code can be contained in the procedure, and LibMain can be eliminated. Note that the LibEntry procedure must pass a nonzero value back to Windows to signal a successful initialization. If the initialization is not successful, LibEntry can return a zero instead, and the loading of the library will fail.

You must take several special considerations into account when writing procedures for a Windows DLL. For starters, every DLL has its own automatic data segment, more commonly called a DGroup. The DLL's DGroup is a single, private, 64K segment that is used by all routines and applications that access the DLL. This one-for-all automatic data segment means that the programmer should be careful not to tie up large amounts of DGroup for extended lengths of time, lest other routines come up short on local storage.

A private, static DGroup variable created in a routine is shared with all program instances that call that routine. If declared public, a static variable can also be shared with other functions in the DLL. Static variables are permanent for the life of the DLL, and if one routine changes the value, the change will be realized by all instances or routines that use the variable.

For temporary variables, it's better to use dynamic memory allocation. To allocate memory dynamically, the API function LocalAlloc is called to get an hMem—a handle—to a block of the local memory. An hMem is an integer value that identifies a particular block of data. The hMem is passed to the API function LocalLock, which returns a near pointer to the block of data. When the program is through using it, the local memory should be freed by calling LocalUnlock and then LocalFree with the hMem of the block. Because the handles are private to the calling program, they must be freed before the program terminates, or the memory blocks will be unavailable to other programs, a situation that may affect the general performance of the DLL.

While it has its own data segment, a DLL does not have a stack. Unlike DOS applications, in which the stack segment and the data segment are the same, a DLL shares the stack segment with the calling program. Thus stack and data segments are different.

In the Windows documentation you'll see several references to DS != SS. This becomes an issue when porting procedures from DOS applications, whose code assumes that DS = SS and thus requires modification of its routines. In Visual Basic, the stack segment size is set to an unchangeable 16K for each program instance. This means that care should be used with recursive routines and local stack variables. If the program runs out of stack space, the error is unrecoverable.

Another consideration in writing DLL procedures is that Visual Basic will only run in the Standard or Enhanced protected mode of Windows. This is good news for assembly programmers, for in protected mode you are guaranteed a minimum of an 80286 or better CPU and you can use the .286P assembler directive.

On a 286 or better machine, certain instructions (for example, Push and Pop) run faster, and others (such as RCR and SHL) can use constants rather than register names as operands. Other programming advantages include the availability of CMOS RAM for system interrogation and services to indicate when an illegal disk change has been made.

Using protected mode under Windows also has a major impact on the use of global memory. In real mode, Windows programmers had to be careful about holding onto memory pointers too long for fear that Windows would discard or move memory and render the pointers invalid. Protected mode uses *selectors* for code and data segments, and Windows can move selectors around without affecting the program that uses them. A selector is actually a pointer into a table of descriptors that Windows maintains. The table

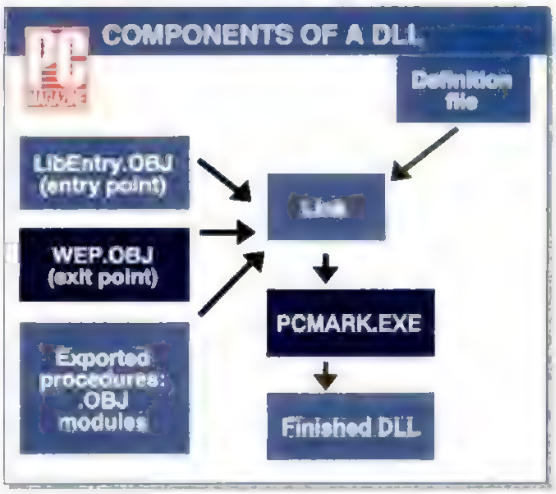

Figure 1: The PCMARK.EXE utility shown in this diagram marks the DLL header as compatible with Windows 3.0.

holds the real memory address and flags describing what type of memory it is (code or data). If Windows needs to move or discard the memory, the table entry of the physical memory address is updated, but the selector remains constant. Protected-mode instructions such as VERR or VERW can be used to verify read or write capability for a selector.

While on the subject of selectors, it's worth pointing out a pitfall into which assembly language programmers may fall. Under protected mode, DS and ES can be loaded only with valid selectors. DOS assembly programmers have long used `LDS` or `LES` to get DWord values from memory quickly. They've also often used ES for a scratch register. Under Windows' protected mode, however, any attempt at loading DS or ES with a nonselector value will cause an error.

Assembly programmers must keep this in mind when working with memory deallocation routines. If you load DS with a selector from a Global Allocation and then call GlobalFree while DS still has the selector, you'll get an error. The problem is that DS is PUSHed by GlobalFree and the selector is then freed or made invalid. When the GlobalFree procedure exits, DS is POPped, but by then it is invalid and causes a crash.

For some assembly programmers, the bad news about using protected mode is that they must give up the bad habit—acquired in real-mode programming—of treating code segments as if they were data segments. If you insist on writing self-modifying code, however, you can write code to your data or stack segment and then execute it with a selector from the Windows AllocDStoCSAlias function. Thus, while there *are* functions that allow writing to the code segment, this is strongly discouraged under Windows.

PROCEDURES AND OBJECT MODULES

Programmers who have been writing libraries for QuickBASIC know that it is desirable to have good *granularity*. The fewer procedures per object module, the greater the granularity. The maximum granularity is one procedure per module.

When a compiled DOS application is linked with a library, only the object modules that contain the called procedures are added to the program. A Windows DLL is very much the same as a DOS library except that the procedures are stored in the DLL and are loaded into memory as needed at runtime. When Windows loads the DLL procedures, it loads only those that are used by the program. Thus, if you keep your library granular, your program will load faster and conserve memory.

At this point it may be useful to look at the components of the DLL file shown in Figure 1. In discussions of DLL routines, the terms *import* and *export* denote how the procedure is used. A DLL exports—makes available—the routines it contains. On the other side, an application is said to import routines from a DLL. The DLL may also import routines such as Windows API routines, as will be discussed below in connection with definition files.

If you assemble using MASM 5.1, you must provide the names of all exported functions in a definition file. MASM 6.0, however, provides the keyword EXPORT, which lets you define the function in the procedure itself.

Windows DLL procedures are written as FAR procedures and use a Pascal calling syntax. In this syntax, an application passes parameters from left to right and requires the called routine to clean up the stack.

The GetVer procedure listed in Figure 2 is a simple routine that returns the Windows version number. It can be assembled with Version 5.0 or later of the Macro Assembler. You'll note that the code is not really much different from that of a DOS procedure except for the addition of the Windows prolog and epilog code. The WinProlog and WinEpilog macros (to be discussed next) contain special Windows entry and exit code and are contained in LABNOTES.INC.

Since GetVer does not use DGroup and has no incoming parameters, the prolog code in this case simply acts as a placeholder. In most Windows procedures, however, the prolog code has a very important task: It determines the data segment for the procedure.

In discussing DGroup above, I indicated that the DLL has its own data segment, which is allocated by Windows when the DLL is loaded. The prolog code handles the assignment of the DGroup selector (in DOS terms, the *segment*) to the program. When an exported DLL procedure is called, Windows places the selector of the DLL's DGroup in AX by replacing the first 3 bytes of the procedure with a

GETVER — COMPLETE LISTING

```
.286P                       ;use 286 instructions
.Model Medium               ;medium memory model

Extrn WinVer:Far            ;Windows Version API function
Public  GetVer              ;DLL routines must be public
Include LabNotes.Inc        ;macros for prolog and epilog

.CODE                       ;simplified code segment

GetVer Proc Far             ;Far procedure
        WinProlog           ;Windows Prolog Macro
        Call WinVer         ;returns version in AX
        WinEpilog           ;Windows Epilog Macro
        Ret                 ;return to VB, no arguments to remove
GetVer EndP
END
```

Figure 2: This sample Windows DLL procedure returns the current Windows version number. Note that it is a FAR procedure and uses the Pascal calling sequence.

WINPROLOG — COMPLETE LISTING

```
WinProlog Macro
        Push    DS      ;load AX into DS for non-exported use
        Pop     AX      ;  (will be replaced by Mov AX,xxxx if
        Nop             ;   exported from a DLL)
        Inc     BP      ;increment BP for memory management
        Push    BP      ;save BP
        Mov     BP,SP   ;create stack frame for accessing parms
        Push    DS      ;save old DS
        Mov     DS,AX   ;set DS to DLL's DGroup (from above)
WinProlog EndM
```

Figure 3: In a Windows DLL, the prolog code handles the assignment of the DGroup selector that an importing program will use.

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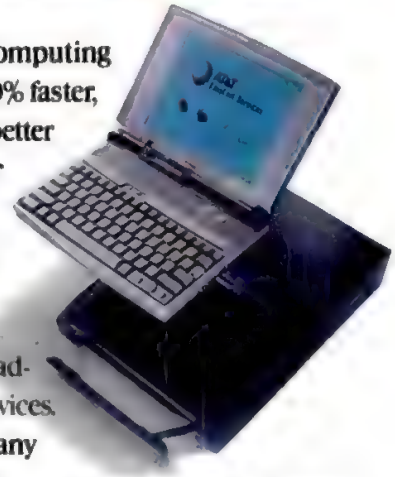

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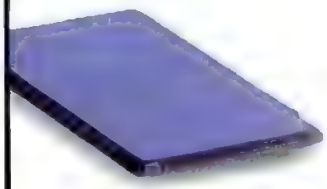

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CIRCLE 242 ON READER SERVICE CARD

MOV AX,[xxxx] instruction, where *xxxx* is the DGroup selector. The normal prolog code is written as PUSH DS, POP AX, NOP, as shown in the WinProlog macro listed in Figure 3. The procedure is then responsible for preserving the old DS and moving AX into DS for use by the program.

The PUSH DS, POP AX, NOP instructions provide Windows with the room it needs to assign the DLL's DGroup. If the routine is called by another DLL function, the PUSH DS, POP AX steps act only as filler and are not overwritten by Windows. In such a case, the value in DS will already be valid, and it only goes through the motions of being put into AX and back into DS.

You may recognize PUSH BP, MOV BP,SP as the code that sets up a standard stack frame, but the INC BP instruction may look a little strange. Windows uses the altered value of BP to distinguish the difference between near and far procedures for memory management. You don't need to worry about this code very much; just realize that it is needed, and be sure to use a macro like the one in Figure 3.

When you exit a procedure, BP and DS must be restored to their original entry values. The epilog code is contained in the WinEpilog macro shown in Figure 4. By using these two macros, the DLL procedures now obtain access to passed parameters through the stack frame. Further, the DLL's DGroup is established, and Windows can perform memory management on the code and data segments safely.

THE EXIT MODULE

Windows requires that all DLLs have an exit procedure, whether the library uses it or not. The Windows Exit Procedure (WEP) is called when the DLL is destroyed, and it may contain code to clean up memory allocations and other resources used in the DLL. As with the LibEntry, the WEP should return a nonzero value. If your DLL (like the LABNOTES.DLL we're building here) does not need to do any cleanup, simply return with a 1 in AX. If exports are listed in the definition file with ordinal numbers, then the WEP also must be listed, along with the keyword RESIDENTNAME. This keyword specifies that WEP's name is to be kept in memory at all times.

LABNOTES.DEF — PARTIAL LISTING

```
LIBRARY LABNOTES.DLL

DESCRIPTION 'Copyright (c) 1992 Jay Munro - PC Magazine May 1992'

EXETYPE WINDOWS

STUB LABSTUB.EXE

CODE MOVEABLE DISCARDABLE
DATA MOVEABLE SINGLE

HEAPSIZE 2048

EXPORTS
    WEP                         @1   RESIDENTNAME
    CONTROLHWND                 @2
    PEEK                        @3
    POKE                        @4
    MKI                         @5
    OUT=VBOUT                   @6
    INTERRUPT                   @7
    GETABS                      @8
    SEG=LSEG                    @9
    SSEG                        @10
    SADD                        @11
    VARSEG                      @12
    VARPTR                      @13


IMPORTS
    LOCALINIT = KERNEL.4
    LSTRLEN = KERNEL.90
    ALLOCCSTODSALIAS = KERNEL.170
    FREESELECTOR = KERNEL.176
    UNLOCKSEGMENT = KERNEL.24
    SETERRORMODE = KERNEL.107
    GETKEYSTATE = USER.106
    __0000H = KERNEL.183
    __0040H = KERNEL.193
    __A000H = KERNEL.174
```

Figure 5: The definition file for LABNOTES.DLL is shown here in abbreviated form, with only a partial listing of exports and imports. Note that KERNEL.183 and KERNEL.193 are undocumented, though very much used.

THE DEFINITION FILE

While the functions that go into a Windows DLL are in themselves not very different from those written for DOS, it is the definition file that makes the DLL.

A DLL is similar in structure to an executable program under Windows. It is created by using the linker to pull together all the various modules. During the process of linking, a definition file is used to specify which files are exports, the amount of local memory to be initialized, and several other DLL properties. The LABNOTES.DLL definition file listed in Figure 5 illustrates the basic structure of a Windows DLL definition file.

The definition file, or .DEF, may contain the following fields that guide the linker in defining the DLL's properties:

- LIBRARY: This defines the name of the library that Windows will use when requested by a call in Visual Basic.

WINEPILOG — COMPLETE LISTING

```
WinEpilog Macro
        Dec     BP          ;skip over saved DS on stack
        Dec     BP          ;   which BP currently points to
        Mov     SP,BP       ;reset Stack Pointer to original value
        Pop     BP          ;retrieve original BP (+1)
        Dec     BP          ;decrement it to get original BP
        Pop     DS          ;retrieve original DS
WinEpilog EndM
```

Figure 4: Windows DLL procedures pass parameters through the stack frame by using the code sequences of WinProlog (Figure 3) and WinEpilog.

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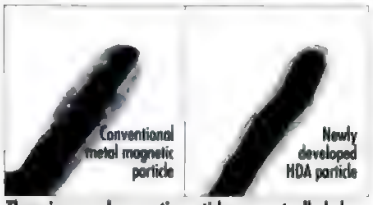

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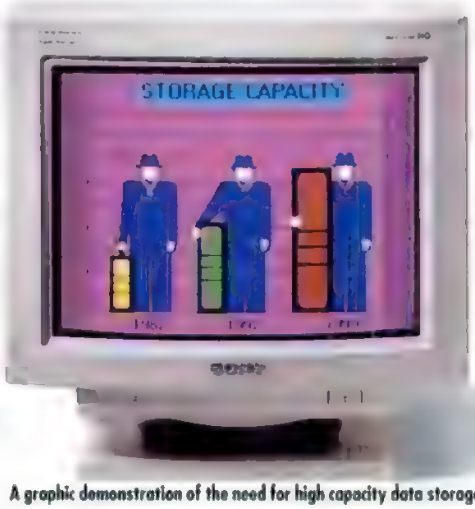

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D8 D-Eight

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■ DESCRIPTION: This field may be used for copyright information or other comments.

■ EXETYPE: This describes the type of executable (OS/2, Windows, or other).

■ STUB: This field is used to contain the name of an optional, small DOS executable program that is run when the library is executed outside the EXETYPE environment. The stub WINSTUB.EXE that comes with the SDK displays the message, "This Program Requires Microsoft Windows." LABSTUB is the LABNOTES.DLL version of the Windows Stub file. DLLs that do not have an .EXE extension may not need the stub file, as the likelihood of their being run from a DOS prompt is slim.

■ CODE: This field describes the properties of the code segments. The declaration here affects how the DLL code is loaded and handled by Windows. The options are: Fixed or Movable, Single or Multiple, Preload or LoadOnCall, and Discardable or NonDiscardable. In terms of memory management, the most flexible setting for Windows is Movable Discardable. Multiple and LoadOnCall are the defaults; they can be explicitly declared if desired. Fixed directs Windows not to move the segment after loading; Movable declares the opposite. Single tells Windows that the DLL is a single segment (used in small models), and Multiple specifies multiple segments (as in medium and large models). Preload tells Windows to load the DLL at runtime, whereas LoadOnCall loads only when the routines are needed.

■ DATA: This describes the properties of the data segment. In LABNOTES.DLL, the data segment is defined as a single, movable segment. Like code, data can be declared as Fixed or Movable, Single or Multiple, and Preload or Load OnCall.

■ HEAPSIZE: This field sets the initial

USING EXEHDR.EXE

by Jay Munro

The Microsoft Segmented-EXE Header Utility (EXEHDR) that comes with the Microsoft Macro Assembler, versions 5.1 and 6.0, is a handy utility for peeking into DLLs. It is of particular interest to programmers who must work without the benefit of the Windows Software Development Kit because the ordinal numbers for exported routines are shown as part of the listing EXEHDR produces. Borland C++ users can also use the TDump utility to get a header listing. Listings created with the TDump utility are more detailed, but since the interest here is only in the ordinal numbers, I'll describe only the tools that come with MASM.

In the absence of an import file for a DLL (such as LIBW.LIB), the ordinal numbers can be used in a .DEF file to import routines.

The syntax for EXEHDR is simply

```
EXEHDR [/v] dllname [ >LPT or
 >filename]
```

The >LPT or >*filename* is optional, though you should note that the output of EXEHDR almost always takes more than one screen to display.

The partial listing shown in Figure A was done on the Windows API library KERNEL.EXE. The top portion displays the information found in the .DEF file used to create the DLL. While the library name, description, data and code information, and the like are important, the items shown in the exports listing are of the greatest immediate interest.

The first column of the Exports listing specifies the ordinal number. This number can be used with the module name and the library name in the import section of your DLL. For example, the ALLOCCSTODSALIAS function that is used in LABNOTES.DLL is listed as ordinal number 170. To list it as an import in the .DEF file, you would use the following syntax:

```
IMPORTS
    ALLOCDSTOCSALIAS = KERNEL.170
```

With the import so listed in the .DEF file, the linker will resolve any calls to ALLOCCSTODSALIAS correctly. ■

AN EXEHDR.EXE DUMP — PARTIAL LISTING

```
Microsoft (R) EXE File Header Utility  Version 2.01
Copyright (C) Microsoft Corp 1985-1990.  All rights reserved.

Library:                KERNEL
Description:            Microsoft Windows Kernel Interface Version 3.00
Data:                   SHARED
Initialization:         Global
Initial CS:IP:          seg   1 offset 91a8
Initial SS:SP:          seg   0 offset 0000
DGROUP:                 seg   4

no. type address  file  mem   flags
  1 CODE 00001340 0bc22 0bc22 PRELOAD
  2 CODE 0000cfe0 02589 02589 PRELOAD, (movable), (discardable)
  3 CODE 0000f790 0126e 01270 PRELOAD, (movable), (discardable)
  4 DATA 00010b20 00220 00220 SHARED


Exports:
ord seg offset name
173 254  f000   __ROMBIOS exported
 19   1  0be7   GLOBALUNLOCK exported
184   1  091b   GLOBALDOSALLOC exported
127   3  0c06   GETPRIVATEPROFILEINT exported
166   2  01e2   WINEXEC exported
122   1  5862   ISTASKLOCKED exported
 99   1  0635   GETLPERRMODE exported
 88   1  5940   LSTRCPY exported
 81   1  07b3   _LCLOSE exported
171   1  18ac   ALLOCDSTOCSALIAS exported
170   1  18ac   ALLOCCSTODSALIAS exported
137   1  4870   FATALAPPEXIT exported
183 254  0000   __0000H exported
 18   1  0bd9   GLOBALLOCK exported
```

Figure A: This partial listing from an EXEHDR dump shows how that utility can be used to learn the ordinal number that corresponds to an exported routine.

size of the local heap. The value is passed to the entry routine in the CX register when the DLL is first loaded. Windows can resize the local heap later if needed.

■ EXPORTS: This defines the public procedures that can be exported from the DLL. The numerals that follow the @ sign are ordinal numbers that applications can use instead of names to call the procedures (see Figure 5). As indicated, the keyword RESIDENTNAME causes the procedure name to stay in memory and not be discarded. Exports can be aliased, as in the case of OUT here. The name OUT is a keyword in MASM and would cause a warning error when compiling. By aliasing OUT as VBOUT, you can use the routine with the common OUT keyword in BASIC while avoiding the error.

■ IMPORTS: This defines routines called from other DLLs. The import definitions are not needed if the external routines called are listed in an Import Library, as are the LIBW.LIB and VBAPI.LIB files. If the ordinal number for an imported routine is known, that number can be listed here and the import library can then be omitted. Imports may also be aliased if your program needs to call routines by another name. To find out which ordinal numbers are assigned a procedure in a DLL, you can use the EXEHDR.EXE utility that comes with MASM to obtain a dump of the library header. The sidebar "Using EXEHDR.EXE" gives more information about its use. To get a text listing of the Windows API USER.EXE library, type this line from a DOS prompt:

```
C:> EXEHDR USER.EXE >USER.LST
```

This will produce the listing USER.LST, which shows all the exported procedures that are contained in the USER.EXE DLL, along with their ordinal numbers. The ordinal numbers can then be used in the .DEF file to access functions without using the Windows LIBW.LIB import library.

PUTTING IT TOGETHER

At this point I'll assume you have successfully assembled your source code and are ready to create the DLL itself. In lining up the object modules for the linker, it is good form to start with the LibEntry module first and work down from there. The listing below is the actual response file (LABNOTES .LNK) that is used to create LABNOTES .DLL from its basic replacement object modules. It can serve as a paradigm for your own DLLs.

```
LIBENTRY.OBJ +
LIBMAIN.OBJ +
CTRLHWND.OBJ +
INTTRPT.OBJ +
OUTINP.OBJ +
MK_CV.OBJ +
GETABS.OBJ +
PEEKPOKE.OBJ +
VBAPI.OBJ
LABNOTES.DLL /a:16,
 nul,,LABNOTES.DEF;
```

The link syntax for a DLL is similar to that for an .EXE file except for the addition of the definition file. If the executable name—LABNOTES.DLL—were not specified, the library would end up with an .EXE extension by default. (The library would still be a DLL, but it would have an .EXE extension.) If you are distributing your DLL, it will be less confusing for your users if you don't use .EXE for libraries.

The linker switch used for alignment—/a:[*size*]—makes a great difference in the size of the DLL file. The default alignment size for Windows DLLs is 512 bytes. Thus, if an object module segment is only 10 bytes long, it still takes 512 bytes of space. The alignment size you select may be any value of 16 or greater that is a power of 2. For LABNOTES.DLL I used a size of 16 bytes for size optimization. For an explanation of the other protected-mode switches, refer to the Link utility section in your MASM manual.

If the link process was successful, the DLL has been created. It is complete with one exception: Windows thinks it was created for an older version of Windows because the header does not contain special Windows 3.*x* flags. Thus, although the DLL could be used as is, when Visual Basic loads it Windows will pop up a message box with an Application Compatibility Warning, "The application you are about to run, [*filename*], was designed for a previous version of Windows." The message goes on to tell you that you should obtain an updated version or run in Real mode. It also warns that you might encounter problems, usually in the form of the dreaded UAE (Unrecoverable Application Error). To complete the creation of a Windows 3.0 DLL, the file must be marked to show that it complies with the rules.

The DLL header contains two sections: the old-style .EXE header and the New Executable (NE) header. Within the NE header are fields that tell Windows that the file will work correctly with Version 3.0. The 1-byte field contains two flag bits. One bit specifies that the executable file can run in protected mode, and the other bit shows that the file can support Windows 3.*x* proportional fonts. An additional byte in the header specifies the Windows version, 3.0 or 3.1, for which the library was created.

The flag bytes may be set, or *marked*, in several ways. If you have the Windows SDK, the resource compiler will process the DLL. One problem that can arise with DLLs created with the SDK resource compiler under Windows, Version 3.1, is that a user who is running Windows 3.0 will be unable to use the DLL. That problem can be neatly solved by using the /3.0 compatibility switch. DLLs created for Windows 3.0 will work fine under 3.1.

Lacking any resources to compile, the RC.EXE utility only marks the file. MARK.EXE, another utility provided with the SDK, does the same job. In the absence of the SDK, the process of linking the response file and updating its header can be done with a simple two-line batch file that uses my own utility, PCMARK.EXE.

```
Link @LABNOTES.LNK
PCMark LABNOTES.DLL
```

PCMARK.EXE, which can be downloaded from PC MagNet, marks an old-style DLL or application, setting the proper flags for use with Win 3.0. The utility verifies that the file has a New Executable header, and aborts with an error message if it does not. PCMARK.EXE's full syntax is

```
PCMARK [drive][path][filename.dll]
```

PCMARK.EXE opens the DLL file and, using information contained in the old-style header, finds the offset of the New Executable header. The NE header is verified and read in. The flags specifying Windows' protected mode and proportional font compatibility are modified, and the header is written back out to the DLL. PCMARK.EXE marks only Windows 2.*x* DLLs and executables for Windows 3.0; it is not able to add resources.

In Part 2 of this Lab Notes we'll look inside LABNOTES.DLL and see how it supplies the QuickBASIC functions omitted in Visual Basic. ■

Jay Munro is a contributing editor to PC Magazine.

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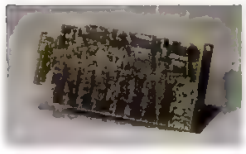

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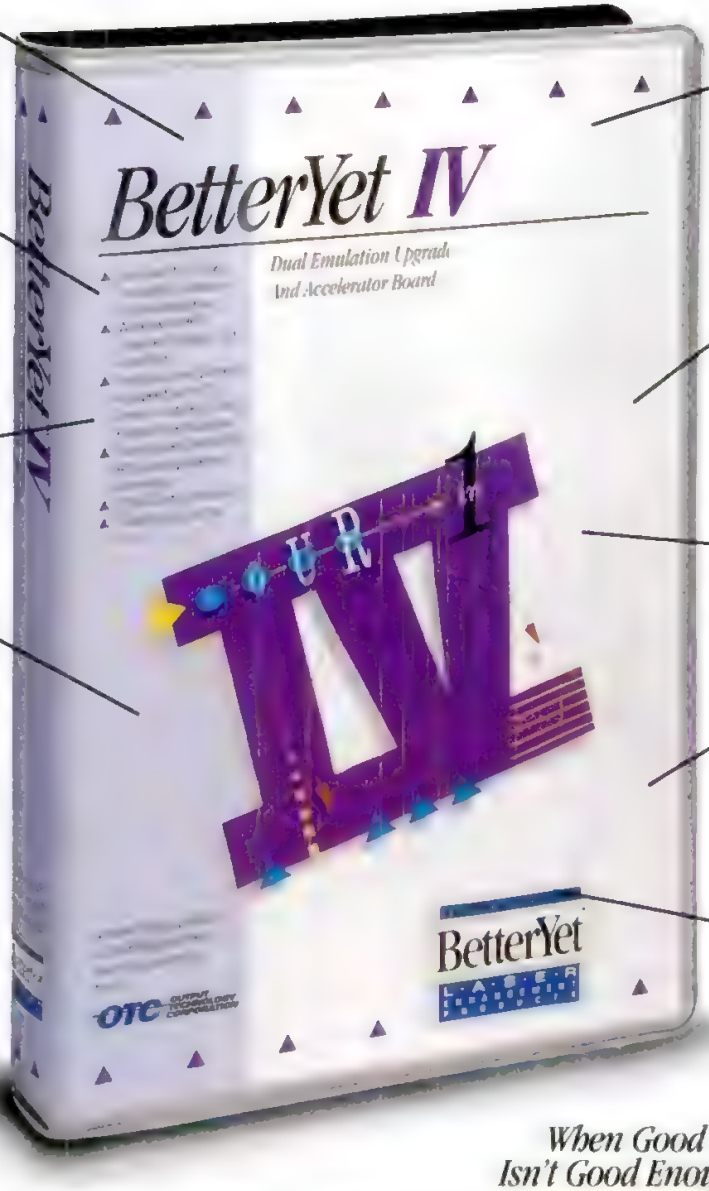

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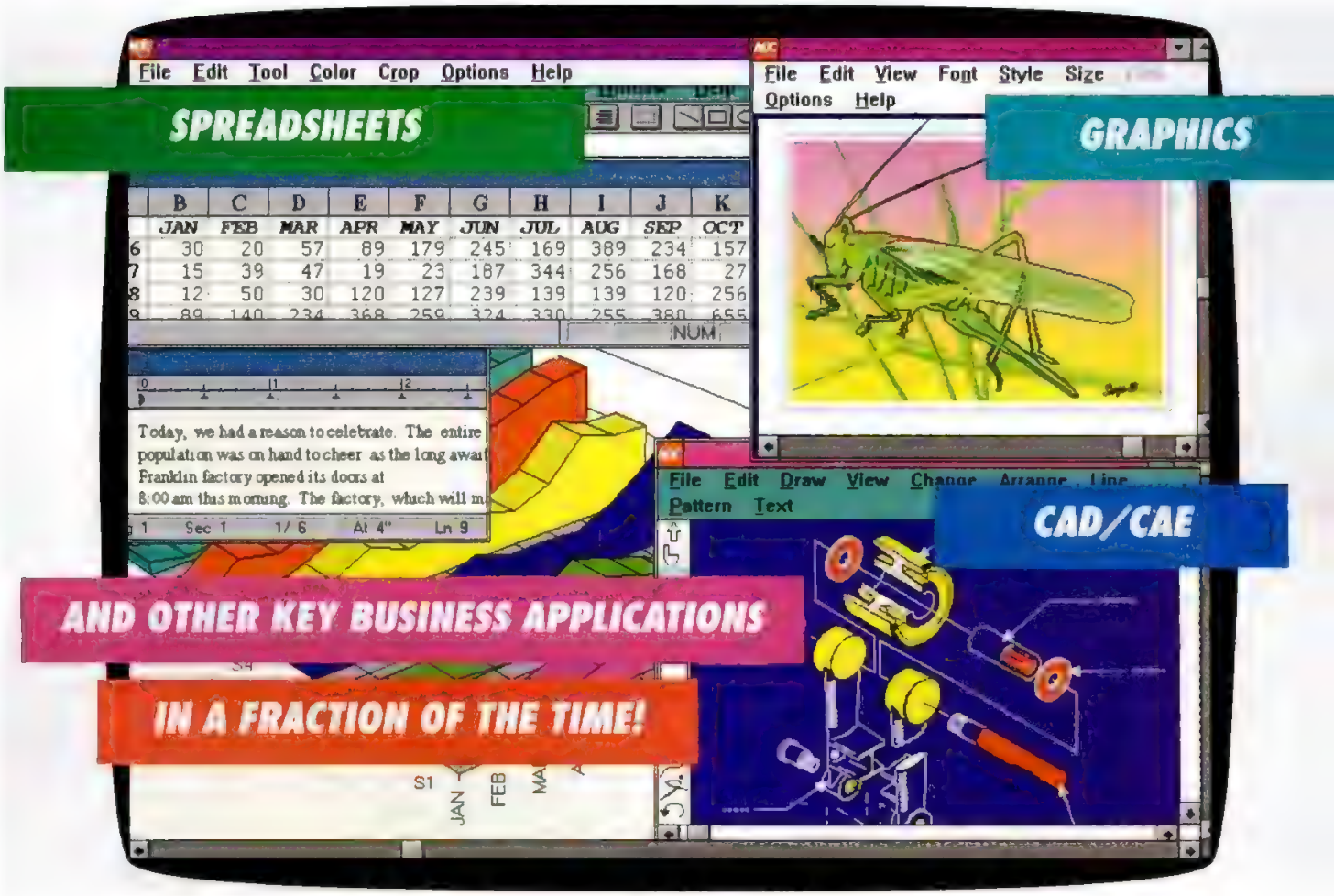

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by
Charles Petzold

Environments

Exploring the Resource Interchange File Format

In this issue, I had originally intended to continue the discussion of the MIDI drum machine program that I wrote for Microsoft Windows with Multimedia Extensions. But as a preliminary, I decided it would be helpful to explore the Resource Interchange File Format (RIFF). I discussed RIFF a bit in my February 11, 1992, column in the context of the waveform audio file format. Here I want to approach the subject from a more general perspective. Part 3 of the DRUM series (which covers the file I/O section) will appear in the next issue, I promise.

The *Microsoft Windows Multimedia Programmer's Reference* says that RIFF is "the preferred format for new multimedia file types. If your application requires a new file format, you should define it using the RIFF tagged file structure." Well, that's pretty clear, and I took the advice when I designed a data file format for the DRUM program.

Lest you rebel at the idea of being pressured to use a predefined file format for your own data files, rest assured that RIFF is more like a framework for your own file format rather than a new file format in itself. It is a way of organizing information in data files. If you already have a file format, you can convert it to RIFF by adding as few as 16 bytes. This simple conversion doesn't fully exploit the advantages of RIFF, of course, but it's a start.

TAGGED FILE FORMATS

RIFF is a tagged file format, which means that the data in the file is organized in blocks of various lengths called *chunks*, each of which is identified by a *tag*. A tag is simply an ASCII string, generally four characters long. (Four characters make it easy to compare tag names with 32-bit integers.) The tag is followed by the chunk's length and data.

Tagged file formats are particularly useful for files that must be interchanged among different applications. Perhaps the most common PC tagged file format used for interchange is TIFF (Tagged Image File Format), which stores bitmapped image data. Many of the chunks in a TIFF file identify the format and certain aspects of the bitmapped data itself.

> ■ We interrupt our examination of the MIDI drum machine program to look first at the format DRUM uses for its data files: the Resource Interchange File Format. It's the preferred format for multimedia data files.

Tagged file formats are helpful because the information in the file is not located at fixed offsets from the beginning of the file, but instead is identified by tags. Thus, the file format can be enhanced with additional tags. When reading the file, programs can easily find the data they need and skip tags they don't need or don't understand.

CHUNKS AND SUBCHUNKS

A RIFF file in Multimedia Windows consists solely of chunks, or blocks of information in the file. A chunk is composed of three items in this order: chunk type, chunk size, and chunk data. The chunk type is a 4-character ASCII tag. It must have no embedded blanks but may be padded at the end with blanks. The chunk size is a 4-byte (32-bit) value that indicates the size of the chunk data. The chunk data must occupy an even number of bytes and is padded at the end with an extra 0 byte if necessary. Thus, every component of a chunk is word-aligned with the beginning of the file. The chunk size does not include the 8 bytes required for the chunk type and the chunk size, and it does not reflect the padding of the data.

For some chunk types, the chunk size may be the same regardless of the particular file. This is the case when the chunk data is a fixed-length structure containing information. In other cases, the chunk size varies depending on the particular file.

There are two special types of chunks: RIFF and LIST. In a RIFF chunk, the chunk data begins with a four-character ASCII form-type, which is then followed by one or more subchunks:

```
"RIFF" chunk-size form-type
 [chunks...]
```

The LIST chunk is similar except that the data begins with a four-character ASCII list type:

```
"LIST" chunk-size list-type
 [chunks...]
```

A RIFF chunk is used for the overall RIFF file, and the LIST chunk is used within the file to consolidate related subchunks.

ANATOMY OF A RIFF FILE

A RIFF file is a RIFF chunk. Thus, a RIFF file begins with the character string "RIFF" and a 32-bit value that indicates

RIFF FILE TYPES

Form type	File description	Extension
WAVE	Waveform audio file	.WAV
RMID	MIDI file	.RMI
RDIB	Device-independent bitmap file	.RDI
PAL	Palette file	.PAL
RMMP	Multimedia movie file	.MMM

Figure 1: The standard RIFF data files defined in Multimedia Windows.

THE STRUCTURE OF A WAVEFORM AUDIO RIFF

Chunk type	Form type	Subchunk type
RIFF size	WAVE	"fmt " size data "data" size data

Figure 2: The organization of a waveform audio (.WAV) file with minimal information.

the size of the file less 8 bytes. (Actually, the file may be 1 byte longer if data-padding is required.)

The form type that follows the RIFF chunk size indicates the type of file. The standard types currently defined in Multimedia Windows are listed in Figure 1. Let's take a look at these standard types to get a feel for the structure of the RIFF. A waveform audio file is organized as shown in Figure 2.

The table in Figure 2 is structured to show the nesting of chunks within the RIFF chunk. The file begins with the string "RIFF" to identify a RIFF file and a RIFF chunk type. The chunk size (the size of the file less 8 bytes) follows. Because this is a RIFF chunk, the chunk data begins with a form type, which is the string "WAVE", indicating a waveform audio file. The form type is followed by two subchunks. For a waveform audio file, these two subchunks are mandatory and must appear in the order indicated.

The first subchunk has a chunk type of "fmt " (note the blank used for padding), which stands for format. The chunk data currently defined for this chunk type is a structure of type PCMWAVEFORMAT, which is 16 bytes long. Hence, the chunk size is 16.

The second subchunk has a chunk type of "data." The chunk data that follows the chunk size is the actual waveform audio data stream, the length of which depends on the sampling rate, the sample size, the number of channels, and the length of time used to record the sample.

The use of chunks allows the structure stored in the "fmt " chunk to be expanded in the future if necessary, and still allow existing programs to recover gracefully if they don't understand the new format.

When reading a waveform audio file, you first check whether the first 4 bytes are "RIFF" and that the form type is

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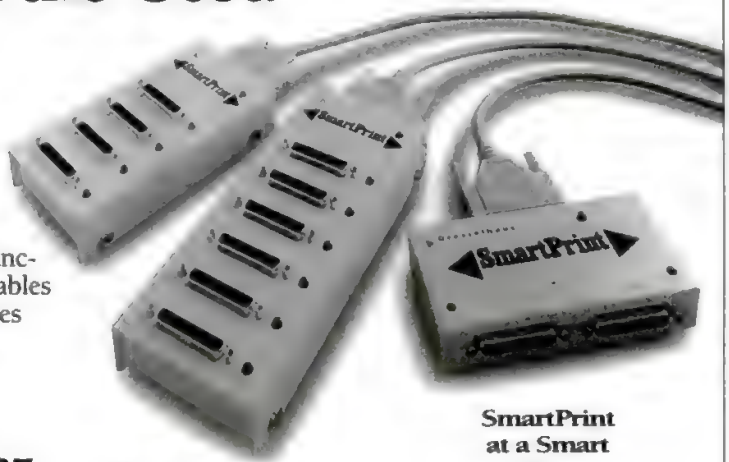

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AN ALTERNATIVE .WAV FILE STRUCTURE

Chunk type		Form type	Subchunk type		List type	Sub-subchunk type
RIFF	size	WAVE	LIST	size	INFO	INAM size data ICOP size data ISFT size data ICRD size data
			"fmt "	size data		
			"data"	size data		

Figure 3: An alternative organization of a waveform audio file with an information LIST chunk.

THE LAYOUT OF A PALETTE FILE

Chunk type		Form type	Subchunk type	
RIFF	size	"PAL "	"data"	size data

Figure 4: The organization of a palette (.PAL) file with minimal information.

"WAVE". Then you can search for the "fmt " chunk. If the chunk size is not the size of the PCMWAVEFORMAT structure, you may not be equipped to handle the file. If the chunk size is okay, then you can read the "fmt " chunk data and check for the WAVE_FORMAT_PCM flag. At that point, you know you can handle the file. All you need to do is search for the "data" chunk and go.

ADDING A LIST CHUNK

Although Figure 2 shows the format of virtually all the .WAV files you'll encounter, the worst thing you can do is hard-code file offsets in your program, because the .WAV file structure shown in Figure 3 is just as legitimate.

In addition to the "fmt " and "data" subchunks, this file also contains a LIST subchunk. This chunk begins with a list type of INFO, which the *Multimedia Programmer's Reference* documents for the storage of information about the file. This is the only list type currently documented.

The INFO list type is followed by subchunks using documented chunk types, each of which identifies information about the file using 0-terminated ASCII strings. The chunk type of "INAM" identifies a name of the data in the file (such as "The Sound of One Hand Clapping"), "ICOP" identifies a copyright notice (such as "Copyright Charles Petzold 1992"), "ISFT" identifies the name of the software that created the file (for example, "WidgetSoft Recorder"), and "ICRD" is a creation date (1992-02-16). The LIST chunk could appear between the "fmt " and "data" chunks or after the "data" chunk.

If you're reading this file and you're not interested in a LIST chunk, simply skip the chunk. Once you read the chunk size of the LIST chunk, you can skip that many bytes in the file—possibly adjusted by one to account for data padding—and read the next subchunk you encounter.

If your program is interested in some but not all of the information in this LIST chunk, you can skip through the subchunks one at a time to find the ones you want.

I have yet to encounter a RIFF file with an INFO list type, except those I've created. When I've created such a waveform file, the Media Control Interface (MCI) of Multimedia Windows has had no problem reading it and playing it. (I can't say the same of the FILEWALK utility included in the Multimedia Development Kit, however.) I suspect that the file structure shown in Figure 3 displays the most complex nesting you'll encounter in RIFF files.

OTHER STANDARD CHUNKTYPES

Three of the other standard chunk types shown in Figure 1 are slightly simpler than the waveform audio file because they require only a "data" subchunk rather than a "fmt " and a "data" subchunk. For example, the layout of the minimum palette file is shown in Figure 4.

The data that follows the "data" chunk type is a structure of type LOGPALETTE, introduced in Windows 3.0 for use in the CreatePalette function. Of course, there could also be a LIST chunk in this file in addition to the "data" chunk.

A RIFF device-independent bitmap file has a filename extension of .RDI. It's very similar to the layout in Figure 4, except that the chunk type is RDIB (which stands for RIFF DIB). The data associated with the "data" chunk is a normal DIB specification. (DIB files not in RIFF have a filename extension of .BMP or

RDUMP.MSC — COMPLETE LISTING

```
#-----------------------------------------------
# RDUMP.MSC make file for Microsoft C/C++ 7.0
#-----------------------------------------------

rdump.exe : rdump.obj
     link rdump setargv ;

rdump.obj : rdump.c
     cl -c -W3 -Tp rdump.c
```

Figure 5: This is a Make file for Microsoft C/C++ 7.0.

RDUMP.BCP — COMPLETE LISTING

```
#-----------------------------------------
# RDUMP.BCP make file for Borland C++ 3.0
#-----------------------------------------

rdump.exe : rdump.obj
     tlink /Lc:\borlandc\lib c0s c:\borlandc\lib\wildargs rdump, \
          rdump, NUL, cs ;

rdump.obj : rdump.c
     bcc -c -P rdump.c
```

Figure 6: This is a Make file for Borland C++ 3.0.

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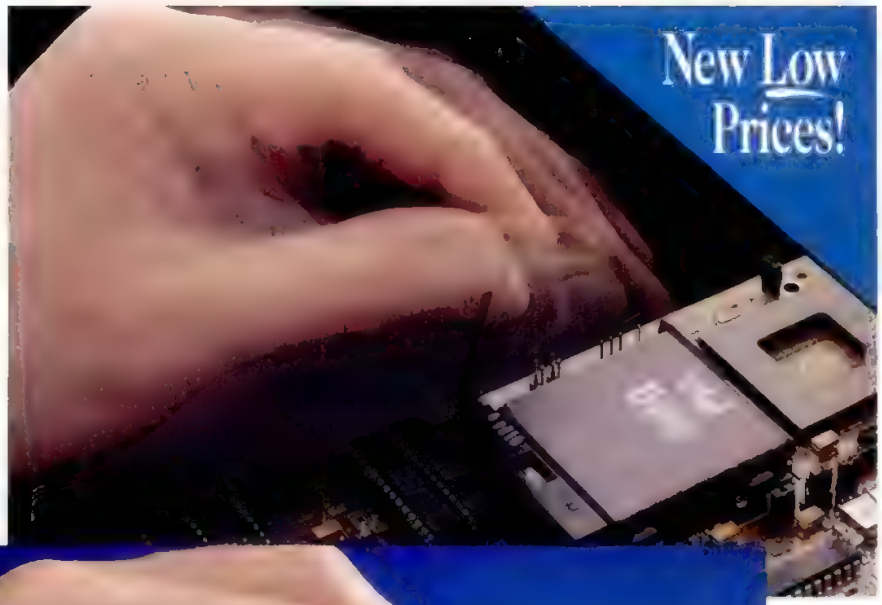

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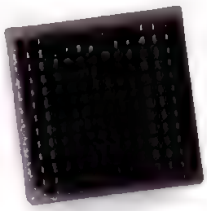

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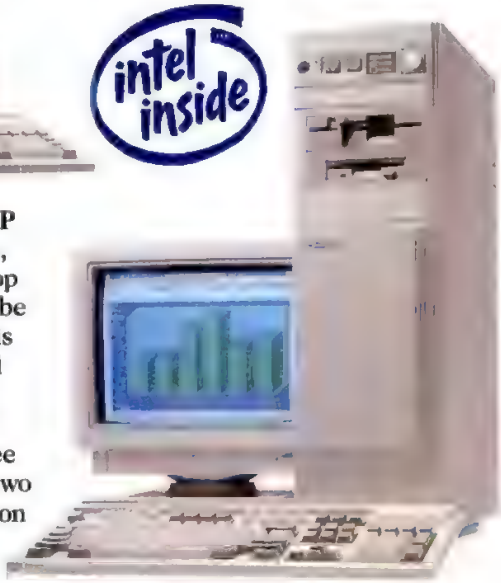

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CODE A4111

RDUMP.C — COMPLETE LISTING

```c
/*----------------------------------------
   RDUMP.C -- RIFF Dumper for DOS
              (c) Charles Petzold, 1992
  ----------------------------------------*/

#include <stdio.h>
#include <string.h>

typedef unsigned int BOOL ;

#define TRUE   1
#define FALSE  0

#define min(a,b) ((a) < (b) ? (a) : (b))

#define HIWORD(l) ((unsigned int) ((l) >> 16))
#define LOWORD(l) ((unsigned int) ((l) & 65535))

long DumpChunk (FILE * file, BOOL bWithinInfoForm, int iLevel)
     {
     static char szBuffer [4096] ;
     BOOL        bRiffChunk, bListChunk, bInfoForm ;
     char        szChunkType [5], szFormType [5] ;
     int         i, iReadBytes ;
     long        lChunkSize, lChunkSizeFile, lFilePos1, lFilePos2, lBytesRead ;

                 // Get the file position to later calculate number of bytes read

     fgetpos (file, &lFilePos1) ;

                 // Read the chunk type and verify that it's in a correct format

     if (fread (szChunkType, 1, 4, file) != 4)
          return 0 ;

     szChunkType [4] = '\0' ;

     if (strlen (szChunkType) < 4)
          return 0 ;

                 // Set Boolean values if the chunk type if "RIFF" or "LIST"

     bRiffChunk = strcmp (szChunkType, "RIFF") == 0 ? TRUE : FALSE ;
     bListChunk = strcmp (szChunkType, "LIST") == 0 ? TRUE : FALSE ;

     if (iLevel == 0 && !bRiffChunk)
          return 0 ;

                 // Read the chunk size, and display the type and size

     if (fread (&lChunkSize, 1, 4, file) != 4)
          return 0 ;

     printf ("%.*s%s %04X-%04X", iLevel + 1, "\t\t\t\t", szChunkType,
                                 HIWORD (lChunkSize), LOWORD (lChunkSize)) ;

     if (bRiffChunk == 1 || bListChunk == 1)
          {
                 // For a RIFF or LIST, read the form type

          if (fread (szFormType, 1, 4, file) != 4)
               {
               printf ("\n") ;
               return 0 ;
               }

          szFormType [4] = '\0' ;

          if (strlen (szFormType) < 4)
               return 0 ;

                 // Set Boolean value if form type is "INFO", and print it

          bInfoForm = strcmp (szFormType, "INFO") == 0 ? bListChunk : FALSE ;

          printf (" %s\n", szFormType) ;

          lChunkSize -= 4 ;

                 // Recursively dump the chunks

          while (lChunkSize > 0)
               {
               if (0 == (lBytesRead = DumpChunk (file, bInfoForm, iLevel + 1)))
                    return 0 ;

               lChunkSize -= lBytesRead ;

               if (lChunkSize < 0)
                    return 0 ;
               }
          }
     else
          {
                 // If it's not a RIFF or LIST, find the chunk size

          lChunkSizeFile = ~1 & (lChunkSize + 1) ;

          iReadBytes = (int) (min (lChunkSizeFile, sizeof (szBuffer))) ;

          if ((int) fread (szBuffer, 1, iReadBytes, file) != iReadBytes)
               return 0 ;

                 // Display the first 24 characters of an INFO
                 // string or the first 8 bytes of binary data

          if (bWithinInfoForm)
               printf (" \"%.24s\"%s\n", szBuffer,
                       lChunkSize > (long) 25 ? " ..." : "") ;
          else
               {
               for (i = 0 ; i < min (8, lChunkSize) ; i++)
                    printf (" %02X", (unsigned char) szBuffer [i]) ;

               printf ("%s\n", lChunkSize > (long) 8 ? " ..." : "") ;
               }

          lChunkSizeFile -= iReadBytes ;

                 // Continue reading the chunk until it's exhausted

          while (lChunkSizeFile > 0)
               {
               iReadBytes = (int) (min (lChunkSizeFile, sizeof (szBuffer))) ;

               if ((int) fread (szBuffer, 1, iReadBytes, file) != iReadBytes)
                    return 0 ;

               lChunkSizeFile -= iReadBytes ;
               }
          }

                 // Determine how many bytes have been read, and return them

     fgetpos (file, &lFilePos2) ;

     return lFilePos2 - lFilePos1 ;
     }

int main (int argc, char * argv [])
     {
     FILE * file ;
     int    i ;

                 // Syntax message if no filenames on command line

     if (argc < 2)
          {
          fprintf (stderr, "Syntax: RDUMP [filename...]") ;
          return 1 ;
          }

                 // For each filename, display the name and call DumpChunk

     for (i = 1 ; i < argc ; i++)
          {
          printf ("\n%s\n\n", argv [i]) ;

          if (NULL == (file = fopen (argv [i], "rb")))
               {
               fprintf (stderr, "\n\tCannot open file.\n", argv [i]) ;
               fclose (file) ;
               continue ;
               }

          if (0 == DumpChunk (file, FALSE, 0))
               fprintf (stderr, "\n\tFile has incorrect format.\n",
                                argv [i]) ;

          fclose (file) ;
          }

     return 0 ;
     }
```

Figure 7: Here is the C source code for the RDUMP program.

.DIB.) Thus, you can think of a .RDI file as a .BMP file or a .DIB file with 16 additional bytes in front.

The same holds true for the RIFF MIDI file, which has an extension of .RMI. The chunk type is RMID. The data part of the file is an industry-standard MIDI file, the format of which I'll be discussing sometime in the near future. A MIDI file that is not in RIFF usually has a filename extension of .MID.

By the way, I have yet to encounter a RIFF .DIB or a RIFF MIDI file. MCI works fine with non-RIFF MIDI files and, of course, Windows works fine with normal .DIB files.

Multimedia movie player files have a chunk type of RMMP and an extension of .MMM. These RIFF files are produced by a conversion utility that works with files created under a Macintosh program called *MacroMind Director*. The "movies" consist of animation and sound. These files usually have numerous subchunks,

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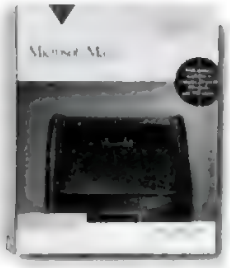

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A SAMPLE RDUMP OUTPUT

```
\win31\chord.wav

        RIFF 0000-618E WAVE
                fmt  0000-0010 01 00 01 00 22 56 00 00 ...
                data 0000-616A 80 80 80 80 00 80 80 80 ...

\viewer\usa\animate\frthfjly.mmm

        RIFF 0005-2BC8 RMMP
                cftc 0000-02F4 00 00 00 00 63 66 74 63 ...
                ver  0000-0006 27 00 00 00 00 00
                mcnm 0000-000E 00 00 00 00 09 34 54 48 ...
                vwcf 0000-0024 00 04 00 00 00 01 00 1E ...
                vwcr 0000-028C 00 04 00 00 00 00 1C 01 ...
                dib  0000-2B58 01 04 00 00 00 00 28 00 ...
                dib  0000-2E5A 02 04 00 00 00 00 28 00 ...
                dib  0000-2AB0 03 04 00 00 00 00 28 00 ...
                dib  0000-2C80 04 04 00 00 00 00 28 00 ...
                dib  0000-2DBA 05 04 00 00 00 00 28 00 ...
                dib  0000-2E2E 06 04 00 00 00 00 28 00 ...
                dib  0000-2F0A 07 04 00 00 00 00 28 00 ...
                dib  0000-2F64 08 04 00 00 00 00 28 00 ...
                dib  0000-3100 09 04 00 00 00 00 28 00 ...
                dib  0000-3112 0A 04 00 00 00 00 28 00 ...
                dib  0000-2F0C 0B 04 00 00 00 00 28 00 ...
                dib  0000-2DAC 0C 04 00 00 00 00 28 00 ...
                dib  0000-2BE8 0D 04 00 00 00 00 28 00 ...
                dib  0000-2B1A 0E 04 00 00 00 00 28 00 ...
                dib  0000-2FFC 0F 04 00 00 00 00 28 00 ...
                dib  0000-339E 10 04 00 00 00 00 28 00 ...
                dib  0000-339E 11 04 00 00 00 00 28 00 ...
                dib  0000-2F36 12 04 00 00 00 00 28 00 ...
                dib  0000-2CB8 13 04 00 00 00 00 28 00 ...
                dib  0000-321E 14 04 00 00 00 00 28 00 ...
                dib  0000-3886 15 04 00 00 00 00 28 00 ...
                dib  0000-48BA 16 04 00 00 00 00 28 00 ...
                snd  0000-6E98 17 04 00 00 0F 66 69 72 ...
                snd  0000-2E17 18 04 00 00 0F 66 69 72 ...
                snd  0000-240D 19 04 00 00 12 66 69 72 ...
                snd  0000-3A3C 1A 04 00 00 12 66 69 72 ...
                vwsc 0000-028A 00 04 00 00 00 66 00 00 ...

\text\env\11-09\sample.drm

        RIFF 0000-01F8 DRUM
                LIST 0000-005A INFO
                        ISFT 0000-0039 "DRUM by Charles Petzold," ...
                        ISCD 0000-000B "1992-02-16"
                fmt  0000-0004 01 00 00 00
                data 0000-017E 3F 00 40 00 20 00 01 01 ...
```

Figure 8: This shows RDUMP output for three different files. The output for a waveform audio file is shown on top, output for a multimedia player file is in the middle, and the botton portion shows output for a file produced by the DRUM program.

the first of which is a table of offsets to the other subchunks in the file. (It's called a "table-of-contents" chunk, and I assume this is done for performance purposes.)

THE RDUMP PROGRAM

For help in exploring RIFF files, I've written a program called RDUMP (RIFF dump), shown in Figures 5 through 7. RDUMP is a simple DOS command line program that accepts one or more RIFF filenames as parameters (wildcards are permitted) and walks through each file, displaying chunk types, chunk sizes, form types, list types, and the first 8 bytes of chunk data in each chunk. For subchunks of a LIST chunk with an INFO list-type, the first 24 characters of the ASCII string are displayed.

The information is roughly in the format shown in Figures 2, 3, and 4, except that each new chunk is on a separate line. Indentation is used to show the nesting of chunks. The top portion of Figure 8 shows output from RDUMP for a waveform audio file, and the middle part of that figure shows a multimedia movie player file.

I must admit, however, that RDUMP aborts with an error message after displaying partial contents of most multimedia movie player files I've encountered. Apparently, some chunk sizes are being stored incorrectly, but Multimedia Windows seems not to notice, probably because the "table-of-contents" chunk stores the offsets correctly.

Due to the nesting of chunks within chunks, using a recursive function makes the most sense for a program such as RDUMP. In RDUMP.C, the recursive function is called DumpChunk and accounts for the bulk of the source code. Besides displaying the chunk types and chunk sizes, DumpChunk must determine if it's dealing with a RIFF or LIST chunk type. If it is, then the function recursively calls itself. If it is not, it displays the beginning of the chunk data.

NEW FORM TYPES FOR RIFF

The discussion of RIFF in the *Multimedia Programmer's Reference* is 45 pages long, but most of it is concerned with describing terminology and notation used for documenting RIFF formats. The *Multimedia Programmer's Reference* also tells how to register new form types with Microsoft, so that RIFF files can be uniquely identified by the form type.

My DRUM program creates and reads RIFF files of a fixed length (512 bytes) using a form type of DRUM and an extension of .DRM. RDUMP output for a .DRM file is shown in the bottom part of Figure 8. As you can see, the .DRM files include two information subchunks (identifying the software that created the file and the creation date) and, like waveform audio files, contain "fmt " and "data" chunks. The "fmt " chunk simply contains the number 1, and the "data" chunk contains the contents of a DRUM structure used within the DRUM program.

If I ever create an enhanced version of this program (for example, one capable of playing a sequence of 64 beats rather than 32), I'll use a format identifier of 2. The "fmt " chunk should allow a program reading the file to prepare itself for reading the "data" chunk or to reject files it can't deal with.

Unlike RDUMP, which "manually" walks through the chunks, DRUM takes advantage of functions that begin with mmio (multimedia input/output). These are file I/O functions specifically tailored for writing and reading RIFF files, and they make the job very easy. That's what we'll look at in the next issue. ■

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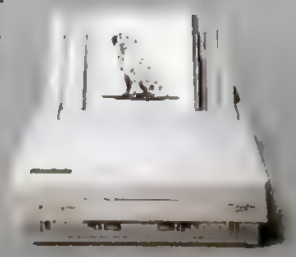

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by
Ray Duncan

Power Programming

The Windows Common Dialogs for Font And Color Selection

■ Building on the sample program presented last time, we continue our discussion of the Windows 3.1 common dialogs with a look at the functions for handling fonts and colors.

In Windows, Version 3.1, Microsoft finally supplies systemwide or *common* dialogs for most of the standard user operations. The code and resources for these dialogs are contained in the dynamic link library COMMDLG .DLL, which is also available in a variety of foreign-language versions. In the previous column we talked about the common dialogs for opening and saving a file. In this installment we'll discuss the common dialogs for font and color selection, and then we'll revise the previous demonstration program to make use of them.

THE FONT DIALOG

In Gutenberg's day, a font consisted of a bunch of little wooden blocks, all the same size, that were stored in a big wooden box and sorted into cubicles according to the character shapes carved on their faces. When the printer wanted to typeset a page, he went first to his cupboard and chose a box that held a collection of blocks with the character shapes and size that he needed. He then picked the little blocks out of the box and painstakingly built up the mirror image of the lines of text, one character at a time. Except for the replacement of the wooden blocks by metal blocks, this technology did not change appreciably for hundreds of years.

Nowadays, at least for our purposes, a font is a collection of bitmaps, one for each symbol in a character set. A particular font is described and selected according to its characteristics:

- *typeface*—the general design of the character set, such as Times Roman or Helvetica;
- *size*—the height of each character cell, usually measured in points or picas;
- *weight*—the thickness of the character strokes, usually described as light, normal, or bold; and
- *style*—other modifiers of the basic character appearance, such as italic, strikeout, or underline.

Another important way of categorizing fonts is whether they are proportional or nonproportional. In a proportional font, the characters have different cell widths; for example, the horizontal space occupied by an *M* will be much wider than that used for an *i*. In a nonproportional or *fixed* font, all characters are the same width.

When you create a window and display text in a Windows program, the Windows graphics engine supplies a default proportional font—the system font—which is designed for easy readability on the screen and gives very good results for most purposes. But if you're writing a word processor application or have some other reason to display text in a different font, you jump immediately into the realm of Windows programming voodoo. Font handling in Windows has always been complex, obscure, and poorly documented, and even fine tutorial books like Charles Petzold's *Programming Windows* leave a great deal of crucial information unsaid. To make matters worse, if you happen to request a font without specifying its characteristics exactly right, the system will often hand you some substitute unlike anything you actually had in mind. And identifying (*enumerating*) the fonts that actually are supported on a particular system is a distinctly messy process.

The common font dialog supplied in Windows 3.1 doesn't entirely eliminate the voodoo but certainly reduces it to manageable proportions. As shown in Figure 1, the dialog presents the user with a list of actual typeface names, sizes, weights, and other parameters, and returns to the calling program a specification for a font that is guaranteed to be available (at least it's guaranteed if you call the dialog function with the proper flags).

Using the common font dialog is very simple. The application program merely calls the ChooseFont() function with a far pointer to a CHOOSEFONT data structure like this:

```
CHOOSEFONT chf;
BOOL status;
.
.
.
status = ChooseFont(&chf);
```

The various fields of the CHOOSEFONT structure are listed in Figure 2.

Luckily, when you are selecting fonts for the screen, most of the fields can be ignored by regular applications, and the following initialization will suffice:

```
LOGFONT lf;
CHOOSEFONT chf;
BOOL status;

chf.lStructSize =
 sizeof(CHOOSEFONT);
```

```
chf.hwndOwner = hWnd;
chf.lpLogFont = &lf;
chf.Flags = CF_SCREENFONTS |
 CF_EFFECTS;
chf.rgbColors = RGB(0,0,0);

status = ChooseFont(&chf);
```

The ChooseFont() function returns a status flag: TRUE if the user selects a valid font, FALSE if the user clicks the Cancel button. If the flag is TRUE, other information about the font selected by the user is returned in both the CHOOSEFONT and LOGFONT structures. The LOGFONT structure, in particular, can be passed immediately to the Windows CreateFontIndirect() function, and the font handle that is returned by the function can be selected into a device context and then used for text output.

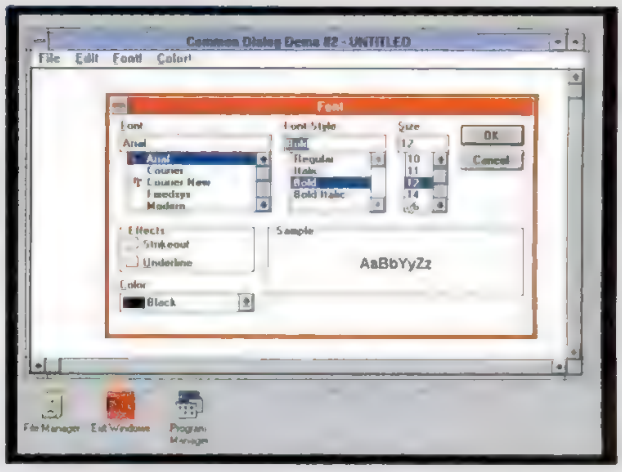

Figure 1: The ChooseFont common dialog. As you can see, the user is presented with a list of typeface names, sizes, and styles.

Like everything else in Windows that has to do with printing, font selection for a printer is somewhat more complicated. Your application must supply a handle for a printer device context (DC), and must also set flags indicating that printer fonts should be listed so that the user can select them. If you so desire, you can set a flag that will cause only those fonts that exist in equivalent forms for both the screen and the printer to be itemized in the dialog.

If your application has specialized needs that aren't entirely met by the common font dialog, you can alter or extend the dialog by defining a custom dialog template and supplying an application hook function. The hook function will get called by COMMDLG.DLL as the user interacts with each control in the font dialog, and it must also handle all messages generated by controls in the custom template

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THE CHOOSEFONT STRUCTURE

Field name	Description
lStructSize	Specifies the length of the structure in bytes.
hwndOwner	The handle for the window that owns the dialog box. Can be zero if the CF_SHOWHELP bit is not set in the Flags field.
hDC	The device context or information context for the printer, if printer fonts are to be selected.
lpLogFont	Points to a logical font (LOGFONT) data structure that will receive information about the selected font and that can be passed directly to the Windows CreateFontIndirect() function.
iPointSize	Receives the size of the font selected by the user, in tenths of a point.
Flags	Contains various option flags that affect the initialization and behavior of the common font dialog.
rgbColors	Contains the initial text color and receives any text color selected by the user.
lCustData	Specifies application-defined data to be passed to the function designated by the lpfnHook field.
lpfnHook	The address of the application's "hook" function for the dialog. Ignored if the CF_ENABLEHOOK bit is not set in the Flags field.
lpTemplateName	Points to a string that specifies the name of the resource file for a custom dialog template. Ignored if the CF_ENABLETEMPLATE bit is not set in the Flags field.
hInstance	The handle for a data block that contains a dialog box template. Ignored if the CF_ENABLETEMPLATE or CF_ENABLETEMPLATE-HANDLE bit is not set in the Flags field.
lpszStyle	Points to a buffer that contains font style data used to initialize the Font Style box in the common dialog.
nFontType	Receives flags that indicate the type of font selected by the user.
nSizeMin	Specifies the minimum font size that can be selected by the user. Ignored if CF_LIMITSIZE is not set in the Flags word.
nSizeMax	Specifies the maximum font size that can be selected by the user. Ignored if CF_LIMITSIZE is not set in the Flags word.

Figure 2: These are the fields of the CHOOSEFONT structure that are used by the common dialog function ChooseFont().

that are not present in the default font dialog. Of course, as soon as you customize the common dialog, you are raising questions of compatibility with future versions of Windows. Still, such customization is probably preferable to cooking up your own font dialog from scratch, at least from an end user's point of view.

THE COLOR DIALOG

Colors are designated in the Windows programming environment according to the red-green-blue (RGB) system. This is an additive system where each color component can take on a value in the range from 0 to 255, and the combination of the three values identifies one out of 16 million colors. For example, RGB (0,0,0) represents black, RGB (255,255,255) represents white, RGB (128,0,0) represents a red of medium intensity, and RGB (255,0,0) represents the brightest red the system can display.

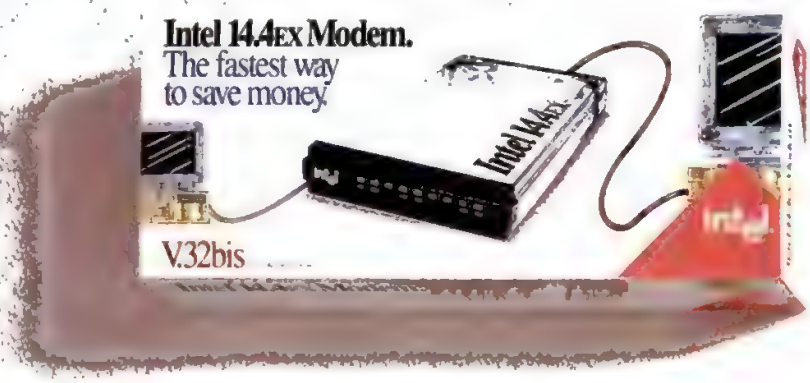
The parameter that identifies a particular color for those Windows API functions that support color is a 32-bit value called a *colorref*, which has the red value in the least significant byte, the green value in the second byte, the blue value in the third byte, and 0 in the most significant byte. A colorref is built from individual red, green, and blue values with the RGB macro

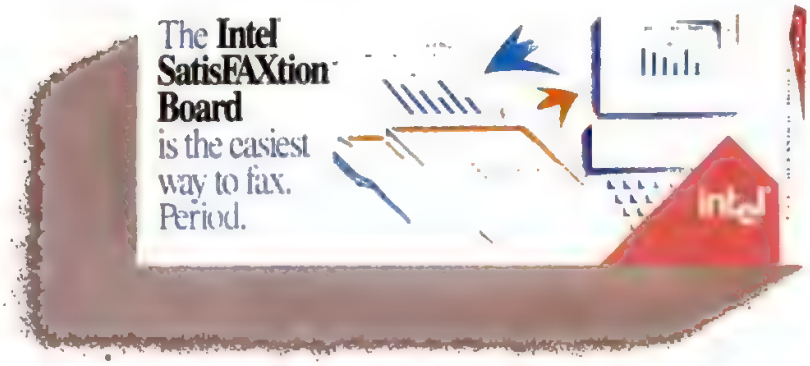
```
int red;
int green;
int blue;
COLORREF clrref;

clrref = RGB(red, green, blue);
```

I'm sure you've noticed that a colorref value has the capacity for many more colors than are available on any but the most expensive PC graphics adapters. Many users still run Windows on VGA adapters in 16-color mode, and virtually all the rest use Super VGA adapters in 16-color or 256-color mode. What happens if your program requests a color that the graphics adapter isn't able to display? The results depend on the operation being performed. If you specify a "pen" color for a line, an arc, a nonfilled closed figure, or text, Windows will choose the nearest pure color. However, if you specify a "brush" color for a background or for the interior of a closed figure, Windows tries to simulate the requested color by blending or *dithering* the appropriate pure colors in alternating pixels. Dithering produces a crosshatched appearance that is very familiar to all of us VGA and Super VGA owners.

At any rate, specifying a color is not intrinsically as difficult a chore as selecting a valid font. But because of the lack of a common dialog for this purpose in earlier versions of Windows, this application task has been very poorly standardized; some third-party attempts to create dialogs that allow users to select a color visually have been severely flawed. This unhappy situation has been complicated by the fact that most programmers and users don't understand the underlying concepts and potential pitfalls of the various color schemas. It's ironic that although color came to the Macintosh much later than to the IBM PC, this is yet another area of GUI programming that was resolved much more promptly—and much more elegantly—on the Mac than in Windows. Ever since the day that color capabilities were added to the Mac, its System software has supported a common dialog for color selection that makes use of a powerful but easily understood "color wheel."

The Windows 3.1 common dialog for choosing a color is not as nifty as the Mac's color wheel, but as you'll see in Figure 3, it's certainly good enough. The dialog presents the color possibilities to the user in two ways. On the left, it contains a grid of the pure colors and simple dithered combinations supported on the adapter. On the right, all the possible colors are shown as a continuous spectrum in terms of the more intuitive hue, luminosity, and saturation (HLS) color





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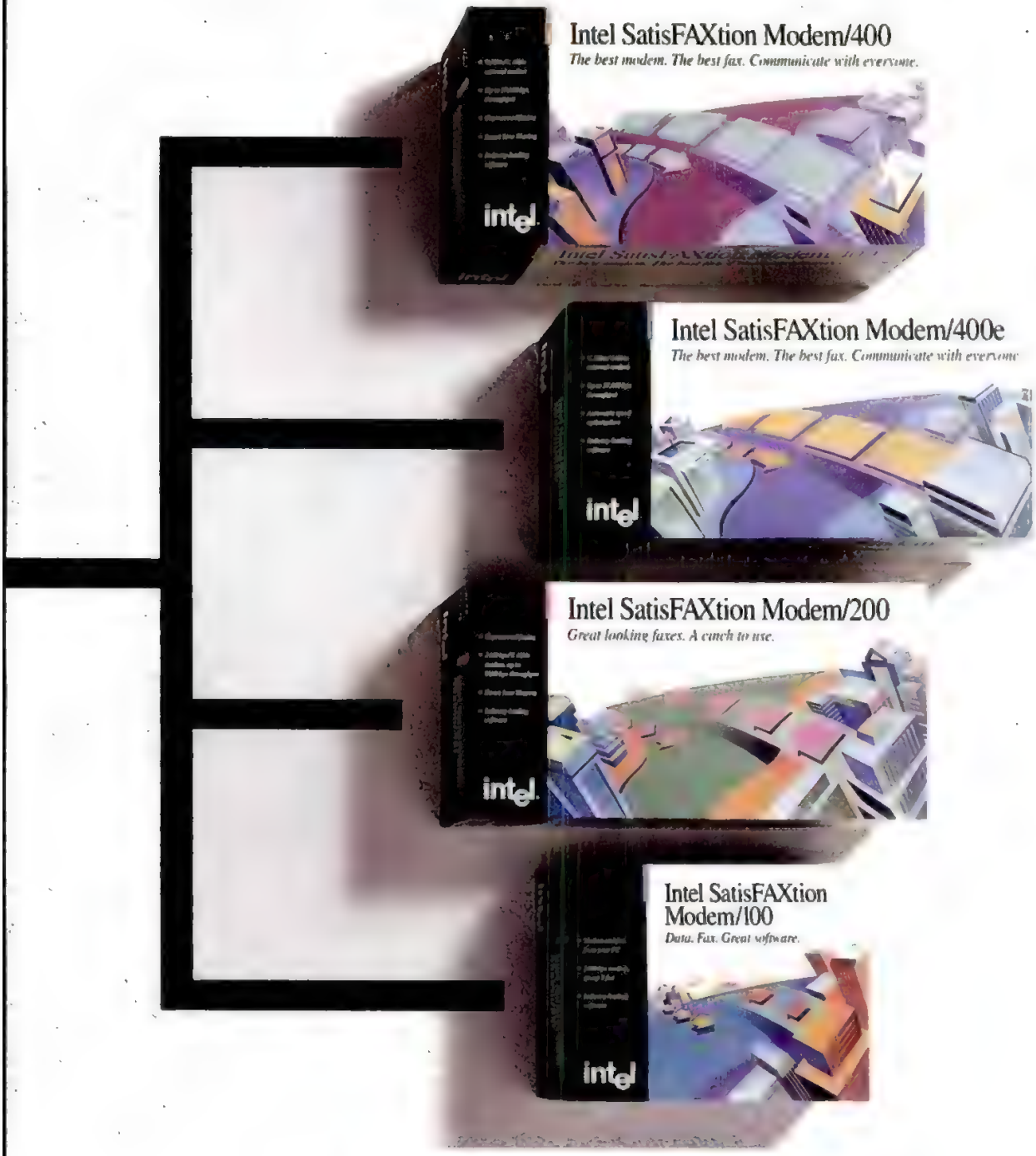

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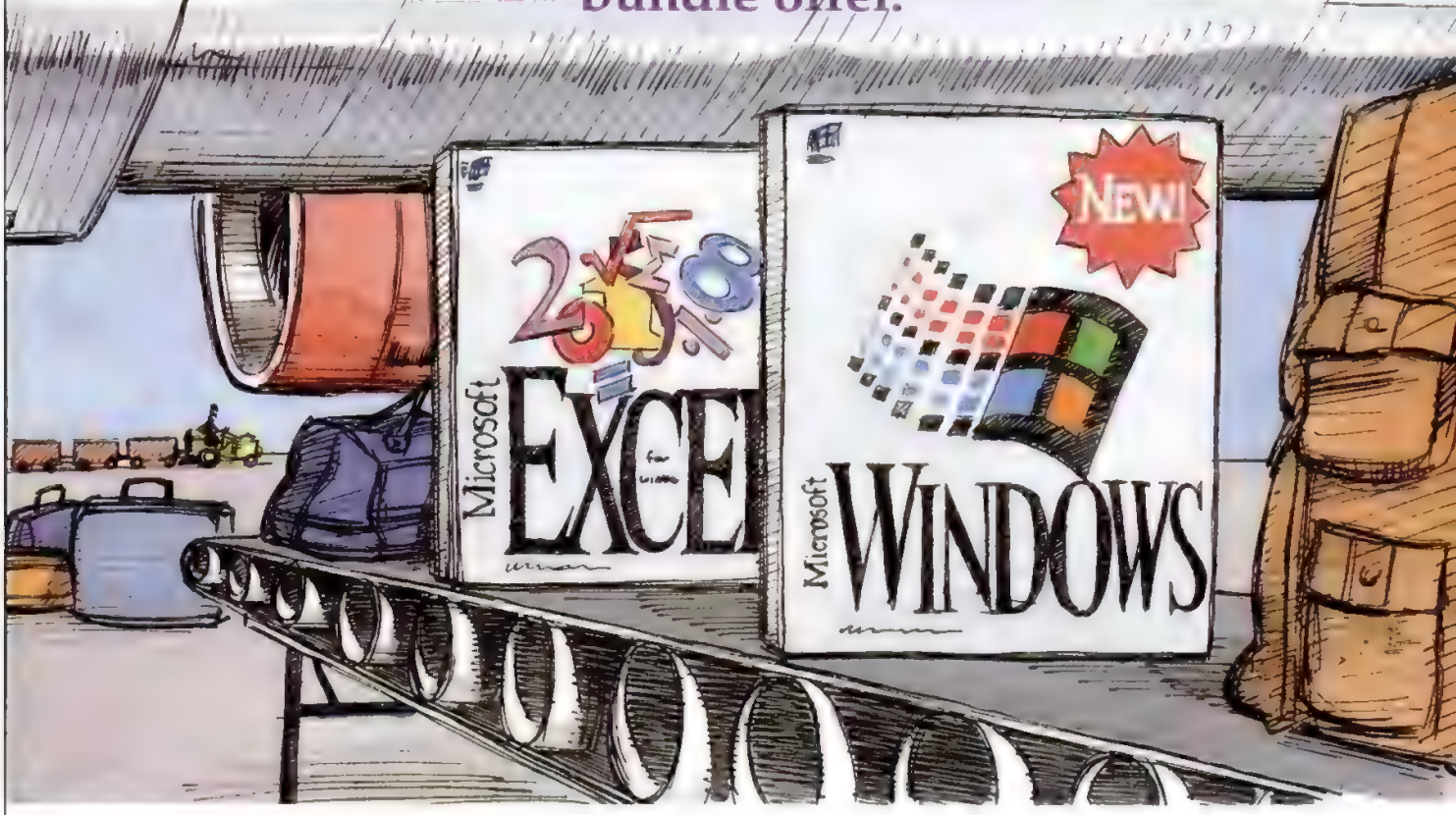

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CIRCLE 068 ON READER SERVICE CARD

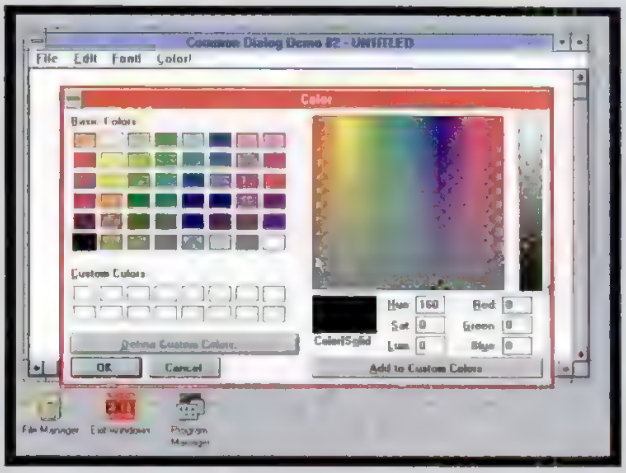


Figure 3: The ChooseColor common dialog. Color possibilities are presented to the user in two ways: a grid showing the pure colors and simple dithered combinations supported on the adapter, and a spectrum of all possible colors.

model. Once the user selects a particular color, the HLS values are translated to RGB values, and all of the numeric values are displayed for possible fine-tuning. Up to 16 custom colors chosen by the user from the right half of the dialog can be saved for future reference and then picked directly from a special supplementary grid in the left half of the dialog.

The procedure for calling the common color dialog follows the pattern we've already seen for the file and font dialogs. The entry point for the color dialog is called ChooseColor(), and you call it with a far pointer to a CHOOSECOLOR data structure:

```
CHOOSECOLOR chc;
BOOL status;
.
.
.
status = ChooseColor(&chc);
```

The ChooseColor() function returns a TRUE flag if the user picked a valid color and then clicked on the OK button, or a FALSE flag if the user clicked on the Cancel button. The actual RGB value for the selected color is returned in the CHOOSECOLOR structure, and any custom colors picked by the user are placed in a separate array, where they can be referenced in a subsequent call to ChooseColor().

The CHOOSECOLOR structure shown in Figure 4 is the simplest of any that we've encountered so far. The amount of structure initialization that is needed under ordinary circumstances is minimal:

```
CHOOSECOLOR chc;
DWORD Color = RGB(0,0,0);
DWORD CustomColors[16];
BOOL status;
int i;

// initialize all custom colors to
 white
for(i = 0; i < 16; i++)
    CustomColors[i] = RGB(255,
      255, 255);

chc.lStructSize =
 sizeof(CHOOSECOLOR);
chc.hwndOwner = hWnd;
chc.rgbResult = Color;
chc.lpCustColors = CustomColors;
chc.Flags = CC_FULLOPEN |
 CC_RGBINIT;

status = ChooseColor(&chc);
```

Just as with the file and font dialogs, you can extend the color dialog by supplying a custom template and a hook function, if your application is sufficiently exotic. Alternatively, if your application's requirements are modest, you can turn on the CC_PREVENTFULLOPEN bit in the CHOOSECOLOR.Flags field, and the user will be offered only the left half of the common color dialog; the custom color facilities will be completely hidden.

THE DLGDEMO2 PROGRAM

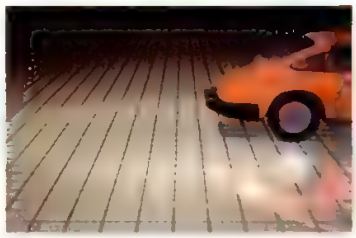
The demonstration program for this issue, DLGDEMO2.C, is derived directly from the DLGDEMO.C program presented in the previous installment of this column. In fact, the table-driven message

THE CHOOSECOLOR STRUCTURE

Field name	Description
lStructSize	Specifies the length of the structure in bytes.
hwndOwner	The handle for the window that owns the dialog box. Can be zero if the CC_SHOWHELP bit is not set in the Flags field.
hInstance	The handle for a data block that contains a dialog box template. Ignored if the CC_ENABLETEMPLATE or CC_ENABLETEMPLATEHANDLE bit is not set in the Flags field.
rgbResult	Contains the initial or default color selection for the dialog box and receives the actual color selected by the user.
lpCustColors	Points to an array of 16 doublewords that contains the initial custom colors to be presented in the dialog box and receives up to 16 custom colors specified by the user.
Flags	Contains various option flags that affect the initialization and behavior of the common color dialog.
lCustData	Specifies application-defined data to be passed to the function designated by the lpfnHook field.
lpfnHook	The address of the application's "hook" function for the dialog. Ignored if the CC_ENABLEHOOK bit is not set in the Flags field.
lpTemplateName	Points to a string that specifies the name of the resource file for a custom dialog template. Ignored if the CC_ENABLE-TEMPLATE bit is not set in the Flags field.

Figure 4: These are the fields used by the common dialog function ChooseColor().

DO 3D ON a PC



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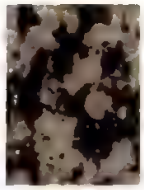
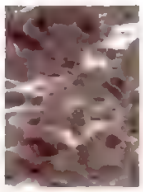
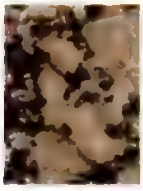
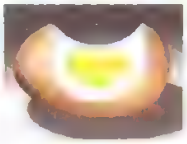
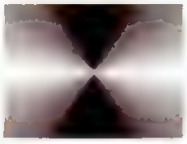
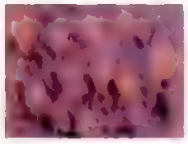
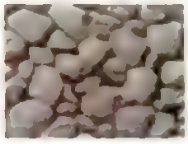




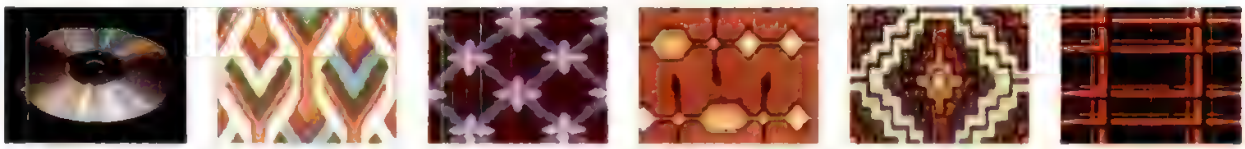






All color art shown was created with Autodesk 3D Studio Release 2. Credits: Living room image courtesy of Jim Biebl, Gaviota Graphics. Atrium image courtesy of Michael Seehman, Seehman & Assoc. MTV sequence courtesy of



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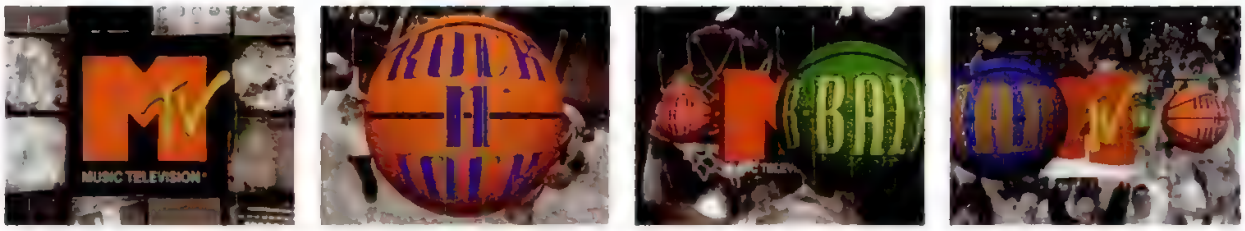

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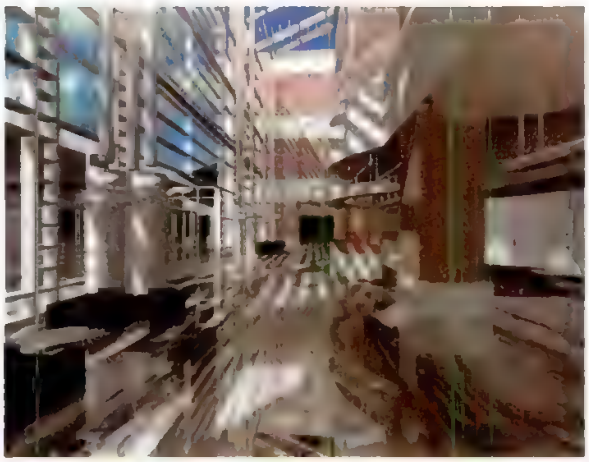

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CIRCLE 114 ON READER SERVICE CARD

DLGDEMO2.C — CODE FRAGMENT

```
    .
    .
    .

//
// Table of window messages supported by FrameWndProc()
// and the functions which correspond to each message.
//
struct decodeWord messages[] = {
    WM_CREATE, DoCreate,
    WM_INITMENU, DoInitMenu,
    WM_SETFOCUS, DoSetFocus,
    WM_SIZE, DoSize,
    WM_COMMAND, DoCommand,
    WM_DESTROY, DoDestroy,
    WM_CTLCOLOR, DoSetColor,
    } ;

//
// Table of menubar item IDs and their corresponding functions.
//
struct decodeWord menuitems[] = {
    IDM_NEW, DoMenuNew,
    IDM_OPEN, DoMenuOpen,
    IDM_SAVE, DoMenuSave,
    IDM_SAVEAS, DoMenuSaveAs,
    IDM_EXIT, DoMenuExit,
    IDM_UNDO, DoMenuUndo,
    IDM_CUT, DoMenuCut,
    IDM_COPY, DoMenuCopy,
    IDM_PASTE, DoMenuPaste,
    IDM_DELETE, DoMenuDelete,
    IDM_FONT, DoMenuFont,
    IDM_COLOR, DoMenuColor,
    } ;

    .
    .
    .

//
// DoSetColor -- process WM_CTLCOLOR message for edit window.
//
LONG DoSetColor(HWND hWnd, WORD wMsg, WORD wParam, LONG lParam)
{
    SetTextColor((HDC) wParam, dwColor);     // set text color from results
    return(GetStockObject(WHITE_BRUSH));     // return background brush handle
}

//
// DoMenuFont -- process Font command from menu bar.
//
LONG DoMenuFont(HWND hWnd, WORD wMsg, WORD wParam, LONG lParam)
{
    LOGFONT lf;                              // logical font data structure
    CHOOSEFONT chf;                          // font dialog data structure
    HFONT hfont;                             // logical font handle

    chf.lStructSize = sizeof(CHOOSEFONT);    // size of structure
    chf.hwndOwner = hWnd;                    // window handle of owner
    chf.lpLogFont = &lf;                     // logical font structure
    chf.Flags = CF_SCREENFONTS|CF_EFFECTS;   // option flags
    chf.rgbColors = RGB(0,0,0);              // default color = black

    if(ChooseFont(&chf))                     // display ChooseFont dialog
    {
        hfont = CreateFontIndirect(&lf);     // save font handle, then send
        SendMessage(hEdit, WM_SETFONT, hfont, TRUE);  // it to edit control
    }

    return(0);
}

//
// DoMenuColor -- process Color command from menu bar.
//
LONG DoMenuColor(HWND hWnd, WORD wMsg, WORD wParam, LONG lParam)
{
    CHOOSECOLOR chc;                         // color dialog data structure
    DWORD dwCustColors[16];                  // array of custom colorrefs
    int i;                                   // scratch variable

    for(i = 0; i < 16; i++)                  // init custom colors to white
        dwCustColors[i] = RGB(255, 255, 255);

    chc.lStructSize = sizeof(CHOOSECOLOR);   // size of structure
    chc.hwndOwner = hWnd;                    // window handle of owner
    chc.rgbResult = dwColor;                 // initial color to select
    chc.lpCustColors = dwCustColors;         // addr of custom color array
    chc.Flags = CC_FULLOPEN | CC_RGBINIT;    // option flags

    if(ChooseColor(&chc))                    // display ChooseColor dialog
    {
        dwColor = chc.rgbResult;             // save new text color
        InvalidateRect(hEdit, NULL, TRUE);   // then force edit window to
        UpdateWindow(hEdit);                 // be redrawn with new color
    }

    return(0);
}
```

Figure 5: An extract from the source code for the DLGDEMO2.C program, showing the structures and functions that are specific to the program's use of the common font and color functions.

and menu command dispatchers in DLGDEMO allowed support for the common color and font dialogs to be added in a very localized, straightforward manner. The relevant tables and code have been excerpted in Figure 5; the complete source code and executable program can be downloaded from PC MagNet.

As we noted before, DLGDEMO, which is basically a clone of the Windows Notepad, falls into the category of "toy" programs. The editing capabilities are simply those that are supported by multiline controls; the program contains no internal editing logic of its own. Furthermore, the size of the file that can be edited is limited by the capacity of a multiline control, which is in turn limited by the size of the program's local heap. Still, DLGDEMO2 is a nice test-bed for the font and color dialogs because it allows you to read an arbitrary chunk of text into a window and then apply different fonts and colors to the same text. Figure 6 shows DLGDEMO2 in action.

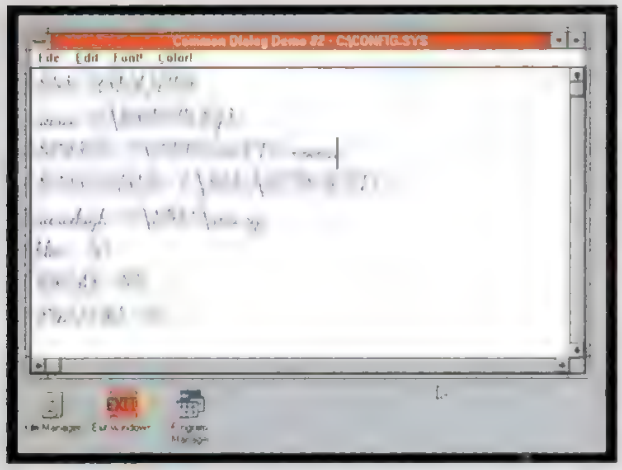

Figure 6: The DLGDEMO2 program in action, demonstrating the display of text in a font and color selected by the user.

In the next issue, we'll augment DLGDEMO further with the common search-and-replace dialogs, then turn our attention to converting DLGDEMO into a true, full-fledged text editor.

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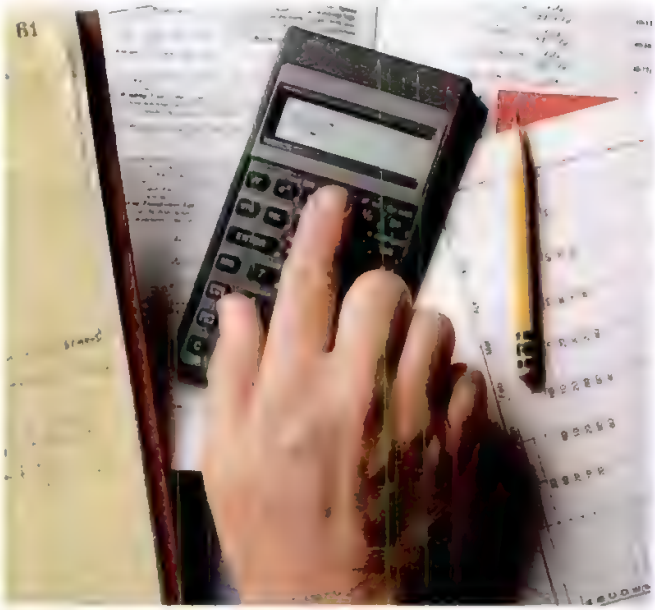

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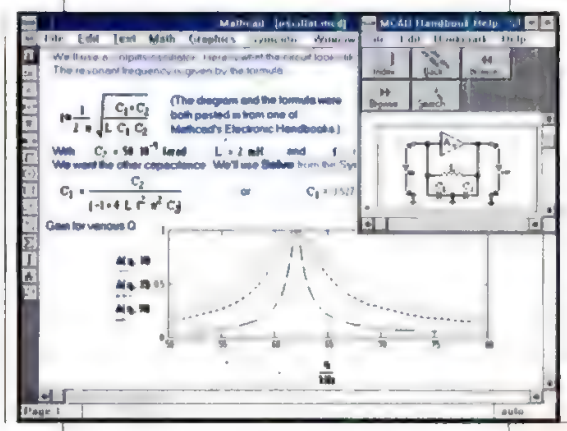

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Databases

FIRST AND LAST OF THE MONTH

In the October 15, 1991, Databases column, you published the EOMD() function, which determines the end of the month by finding the start of the next month and subtracting 1.

The EOM() function shown in Figure 1 is an even faster way to locate the last date in a month. I've also included a fast way to find the first date in a month, without having to do a lot of string parsing and concatenation.

John Kaster
Alexandria, Virginia

- FIRST AND LAST OF THE MONTH: Techniques to return the beginning or ending date of the month in *Clipper* quickly.
- FINDING THE CLOSEST MATCH: Here's a *Paradox* procedure that lets you locate the closest match if no exact match exists.

PC MAGAZINE Mr. Kaster's EOM() routine is at least twice as fast as the EOMD() function. It works by calculating a date somewhere in the month after the one in the date parameter, and then subtracting out the day portion of the date (as returned by the DAY function).

It's interesting to note that while this function is much faster than EOMD() when using *Clipper*, it is less so (25 percent faster) when converted to *FoxPro*, and shows no improvement at all when converted to *dBASE IV*. This illustrates my First Rule of Database Programming: *All algorithm decisions are subject to re-examination when you switch dialects or receive a significant upgrade to your current dialect.* Clearly, the best way to do something in *Clipper* may not be the best way to do the same thing in *dBASE*. Each vendor's implementation comes with its own unique set of performance characteristics.

You might be tempted to think the BOM() function is not necessary. After all, since every month begins with 1, finding the first of the month is a simple matter of converting the date to a string; breaking it into its component parts of month, day, and year; concatenating the month portion with "/01/" followed by the year; and finally converting the resulting string back to a date variable.

While that approach will work, Mr. Kaster's BOM() function saves you from having to do all of that conversion and string concatenation, and as a result, requires much less time to do its work.

BOM() AND EOM() FUNCTIONS — COMPLETE LISTING

```
*********************************************************************
* FUNCTION BOM( dDay )                                   Clipper 5
* Return the first date of the month
*********************************************************************
FUNCTION BOM( dDay )
   IF dDay == NIL
      dDay := DATE()
   ENDIF
RETURN dDay - DAY( dDay ) + 1
*********************************************************************
* FUNCTION EOM( dDay )                                   Clipper 5
* Return the last date of the month
*********************************************************************
FUNCTION EOM( dDay )
   LOCAL dBump
   IF dDay == NIL
      dDay := DATE()
   ENDIF
   dBump := dDay + 35 - DAY( dDay )          // Somewhere in next month
RETURN dBump - DAY( dBump )
```

Figure 1: Two *Clipper* functions for determining the first and last date of the month, respectively, based on a date parameter.

FINDING THE CLOSEST MATCH

Paradox allows you to view a table in table view, where the rows are sorted by the primary sort field. For example, a table sorted by [Last Name] would appear ordered like this:

```
Abel
Brown
Smith
Taylor
Williams
```

Paradox has several commands that let you search for exact or partial matches on a value in any field. But there's no command that will find the "closest match" if the search value doesn't exist. For example, if you searched for the name "Smythe" in the list of last names shown above using either the ZOOM or LOCATE command, *Paradox* will simply report "not found."

The BinarySearch procedure shown in Figure 2 does the type of search we're looking for. Using *Paradox*'s MOVETO command, the routine does a binary search for the user-entered value. If the value doesn't exist, the cursor is positioned on the record containing the next closest match. For example, using this procedure, if the user enters "Smith", "Smithson", "Smiley", or even "S", "Sm", or "Sma", the procedure will position the table to the closest match, "Smith". Also, if the user enters "Richards", since there

are no names beginning with "R" the table is positioned to "Smith", the next closest match.

Annette B. Gates
Richmond, Virginia

This is useful if you want to be left at the row that comes nearest to matching your search value when an exact match is not found. Normally, if you just want to find any record that begins with a certain letter, you can use ZOOM or LOCATE with a wildcard. For example, ZOOM SELECT "S.." will find the first last name that starts with "S" if the last name column exists in the active database. However, if there are no records in which the value of the selected field begins with "S", *Paradox* doesn't move the cursor at all.

The BinarySearch procedure takes a divide-and-conquer approach, and relies on the fact that the column you're searching is sorted in ascending order. If it isn't, the procedure will not work.

The basic algorithm works like this: First, it compares the value you are searching for with the value in the middle of the list (in this case a sorted table). If the value there is larger than the value you are searching for, you can safely eliminate it and all of the subsequent records from the search. Since the algorithm requires a sorted column, all of the remaining records *have* to be greater than the search value if the middle value is greater.

Similarly, if the value in the middle is less than the value you are searching for, you can safely eliminate it and all prior records from consideration. After performing this elimination step, you then start over again, going to the middle of the remaining records and continuing to reduce the work set until you find a match, or until the set is exhausted.

In this manner, with each comparison, the algorithm eliminates approximately half of the rows from consideration using *Paradox*'s MOVETO command to position the row cursor before each comparison is made. Since the cursor is moved before each comparison, when the search is completed, the cursor is on either a matching value or the row that contains the next closest match.

The DoBinary script in Figure 2 works like the ZOOM command. It prompts you in the upper-left-hand corner of the screen to enter a value to search for. After you enter the value, DoBinary calls BinarySearch to find the closest match.

You can assign the routine to a key combination by putting both BinarySearch and DoBinary in your Autolib library, and by including a SETKEY command in your INIT.SC script. For example,

```
SETKEY 2 DoBinary()
```

binds the DoBinary() procedure to Ctrl-B. The valid keycodes can be found in Appendix B of the *PAL User's Guide*. The procedures in Figure 2 can be found in BINSCH.ZIP on PC MagNet.

DOBINARY AND BINARYSEARCH PROCEDURES — COMPLETE LISTING

```
;*********************************************************************
; PROC BinarySearch(SearchVal)                                Paradox 3.5
; Binary search to locate closest match.  SearchVal is the
; string to search for.   Only works on sorted columns (primary key
; or physically sorted.)
;*********************************************************************
PROC BinarySearch(SearchVal)
PRIVATE
  Found,                          ; Controls while loop
  LowRec,                         ; Lower limit of current search area
  HighRec,                        ; Upper limit of current search area
  ThisRec                         ; Current record to compare to searchval

MESSAGE "Searching"               ; Display message
SearchVal = UPPER(SearchVal)      ; Convert to upper case
LowRec = 1                        ; Initialize
HighRec = NimageRecords()         ; Get number of records
Found = FALSE                     ; Initialize

WHILE Found = FALSE
                                  ; Find midpoint of current search area
  ThisRec = INT((LowRec + HighRec) / 2)
  MOVETO RECORD ThisRec           ; Move to midpoint record
  IF SearchVal = UPPER([]) THEN   ; If SearchVal matches current field
    Found = True                  ; Record found
  ELSE
    IF SearchVal > UPPER([]) THEN ; Next search area will be upper half of
      LowRec = ThisRec + 1        ;   current area
    ELSE                          ; Next search area will be lower half of
      HighRec = ThisRec - 1       ;   current area
    ENDIF
    IF LowRec > HighRec THEN      ; We're finished
      Found = "Match not found"   ; So exit the while loop
    ENDIF
  ENDIF
ENDWHILE
IF (SearchVal > UPPER([])) THEN
  MOVETO RECORD ThisRec + 1
ENDIF
ENDPROC

;*********************************************************************
; PROC DoBinary()                                             Paradox 3.5
; Acts similar to the ZOOM command, but calls PROC BinarySearch().
;*********************************************************************
PROC DoBinary()
IF IMAGETYPE() = "Display" THEN          ; Only for Display images
   STYLE ATTRIBUTE 63                    ; Look like Paradox
   @ 0,0 ?? "Value:  "
   @ 1,0 ?? "Enter a value to search for." + SPACES(52)
   @ 0,8 ACCEPT "A72" TO SearchVal       ; Get value to match
   BinarySearch(SearchVal)               ; Look for it
   STYLE
ELSE BEEP
ENDIF
ENDPROC
```

Figure 2: The DoBinary and BinarySearch PAL procedures perform a binary search on a field, letting you locate the next closest match when an exact match isn't found.

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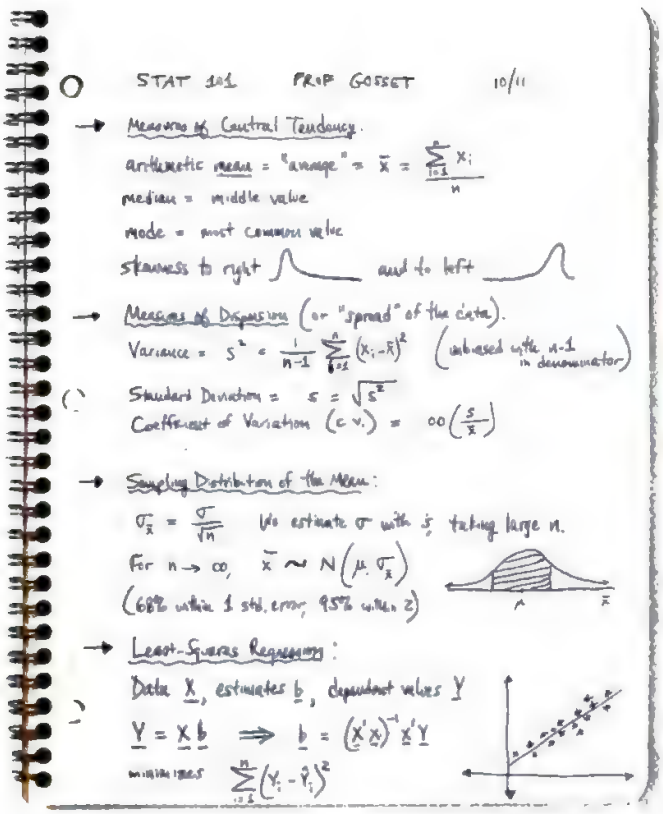

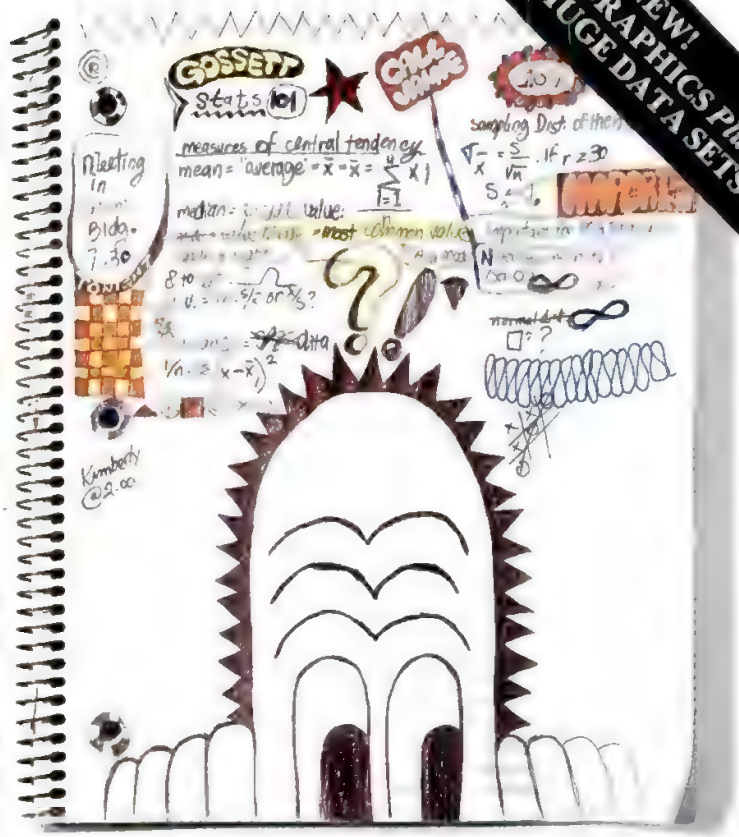

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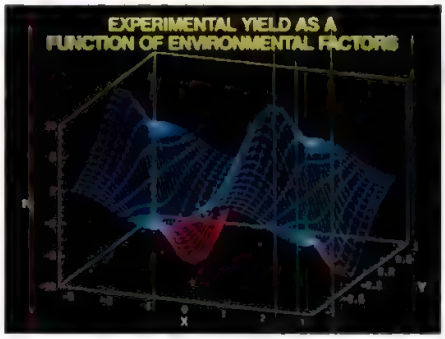

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CIRCLE 193 ON READER SERVICE CARD

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Languages

MINIMIZING PASSED PARAMETERS

Passing several arguments to a SUB or FUNCTION procedure quickly increases the size of QuickBASIC programs, especially if the procedure is called many times. One way I've found to minimize the number of parameters is to combine several parameters into a single variable. CENTER.BAS, the example subprogram shown in Figure 1, accepts a row and text string and then displays the text centered on that row. The original version of this routine required two additional parameters: one to indicate whether the screen type was to be normal, reverse, or flashing, and another to indicate whether the user had to press a key before being returned to the application. Now, however, the Row parameter also specifies the text coloring and the action.

If the value for Row is greater than 100, the text will be printed as reverse. A Row value greater than 1,000 means the text will blink. A negative Row value indicates that the message is a warning or an error message and the Center routine is to pause for a keystroke as acknowledgment. Of course, you can expand this technique by adding more conditions with ever-higher values.

Note that the various tests need to be performed in a particular order. You must test for a negative value first and, if the value is negative, convert it to an equivalent positive number. Then perform the remaining tests, from the highest values downward.

Edward E. Hastings
Villanova, Pennsylvania

For each variable that is passed as an argument to a BASIC subprogram or function, BASIC generates 4 bytes of code. When constants are passed, even more bytes of code are created, depending on the type of data. Therefore, it's usually best to avoid long argument lists. Do note that using Mr. Hastings's technique might increase a program's size, due to the extra code that is needed to combine and later separate the parameters. Only by counting bytes or through experimenting can you really know whether the added effort will be worthwhile.

- MINIMIZING PASSED PARAMETERS: Here are several ways to reduce the number of arguments you need to pass to a BASIC subprogram or function.
- TP's HEAP ERROR FUNCTION: Turbo Pascal's heap error function adds intelligence to memory allocation—but you can cause trouble by using it in OWL programs.

There are some other solutions besides the one Mr. Hastings proposed. One is to use DIM SHARED or COMMON SHARED to establish frequently used variables as global throughout an entire program. The advantage of sharing is that no code at all is needed to access the parameters in each procedure. When you rely on sharing many variables in a large and complex program, however, you take the risk of modifying one inadvertently. If you use the same variable name in a procedure as one that is also being shared, your program will automatically change the global variable when you didn't intend it to do so.

Another solution is to use TYPE variables. A TYPE variable in BASIC can contain many individual components, and all can be passed using the same 4 bytes needed to pass a single argument.

Yet another method is to set and test the individual bits in an integer variable.

CENTER.BAS — 1 OF 2

```
DEFINT A-Z

DECLARE SUB Center (Row, Text$)
DIM SHARED Foreground, Background

Message$ = "This is a test message to be centered"
Foreground = 15
Background = 1

COLOR Foreground, Background
CLS

Row = 10                    'display the message on line 10 and return
CALL Center(Row, Message$)

Row = -12                   'display the message and also wait for a key
CALL Center(Row, Message$)

Row = 14 + 100              'display the message in inverse, no wait
CALL Center(Row, Message$)

Row = 16 + 1000             'display the message blinking, no wait
CALL Center(Row, Message$)

Row = -(18 + 100)           'display the message in inverse and also wait
CALL Center(Row, Message$)
```

Figure 1: This simple routine shows how a single argument can be used to specify more than one action in a procedure.

CENTER.BAS 2 OF 2

```
SUB Center (Row, Text$)                 'centers text on given line

  L = Row: T$ = Text$                   'protect incoming parameters

  IF L < 0 THEN                         'wait for a key before leaving
    WaitKey = -1                        'set a flag for later
    L = -L                              'revert to a positive value
  END IF

  IF L > 1000 THEN                      'blink the message
    COLOR Foreground + 16               'these are shared from main module
    L = L - 1000                        'normalize the row
  END IF

  IF L > 100 THEN                       'print in inverse
    COLOR Background, Foreground        'these are shared from main module
    T$ = " " + T$ + " "                 'extend highlight 1/2 space each end
    L = L - 100                         'normalize the row
  END IF

  LOCATE L, 41 - LEN(T$) \ 2            'position on line for centering
  PRINT T$;                             'display message
  COLOR Foreground, Background          'restore normal colors

  IF WaitKey THEN
     WHILE LEN(INKEY$): WEND            'first clear the keyboard buffer
     WHILE LEN(INKEY$) = 0: WEND        'then wait for a key press
   END IF

END SUB
```

Since an integer contains 16 separate bits, each can be used as a True/False flag. To set a given bit in an integer without changing any of the other bits in that interger use the following

```
Var% = Var% OR 2 ^ Bit%
```

where Bit% ranges from 0 through 15. And to turn off a given bit you would use AND and NOT, like this:

```
Var% = Var% AND NOT 2 ^ Bit%
```

Inside your procedure, bits can be tested using

```
IF Var% AND 2 ^ Bit% THEN
```

to determine whether an individual bit is turned on. For the best efficiency, you should calculate the powers of 2 ahead of time, since raising a number to a power in Microsoft BASIC requires floating-point math, which is slower than integer-only operations.

To calculate these values, simply use PRINT to display the answer. For example, you would use `PRINT 2 ^ 3` to determine the value for setting bit number 3, and `PRINT NOT 2 ^ 7` to determine the value to use with AND when clearing bit number 7.—*Ethan Winer*

TP'S HEAP ERROR FUNCTION

Many Turbo Pascal programmers set the HeapError variable to point to a new and very simple HeapFunc function to make it return 1:

```
FUNCTION HeapFunc(Size : Word) :
  Integer; FAR;
BEGIN
   HeapFunc := 1;
END;
```

This way, any time a program makes a call to GetMem a Nil pointer will be returned if there is not enough memory available to satisfy the request. This makes memory allocation errors much easier to manage. The feature also exists in Turbo Pascal for Windows.

I used this feature in my Object Windows Library programs until I took a look at the source code for the WObjects unit and noticed that it already implemented a new HeapFunc function—one that shouldn't be overridden. This function is already set up to return 1 if GetMem fails, 0 if the system is in a Low Memory state, and 2 to trigger a retry after releasing the memory safety pool.

This feature is not documented in the TPW manuals. Since the function is set up to terminate the application when memory becomes very low, you shouldn't override it with the usual HeapFunc code. Doing so would cause the program to terminate even though TPW might have enough memory in its safety pool to satisfy the request.

Patrick Philippot
Draveil, France

PC MAGAZINE The HeapFunc variable itself is documented in Turbo Pascal for Windows, in the *Programmer's Guide*. It is a pointer to a FAR function that takes a Word parameter defining the size of the desired memory block, and it's called by New or GetMem if there's not enough memory to satisfy a request for allocation. The heap error function can return 0, indicating failure and allowing a run-time error to occur. It can return 1, still indicating failure, but causing the program to set the requested pointer to NIL with no run-time error. Or it can attempt to free up some memory and return 2, which tells the calling function that it should try again.

The simple heap error function shown above always returns 1, making it easier to allocate dynamic variables without risking a run-time error. Your programs just attempt whatever allocation they need and check to see if the resulting pointer is NIL; if so, they can deal with the error gracefully.

However, any OWL program already *has* a heap error function—one that's more sophisticated than the simple one shown above. OWL programs maintain a "safety pool" of heap memory, with a default size of 8K. If an attempt to allocate memory has failed, the OWL heap error function frees up the safety pool and returns 2, indicating that the calling program should try to allocate the memory again. You certainly don't want to accidentally wipe out that useful behavior by installing your own heap error function! —*Neil J. Rubenking*

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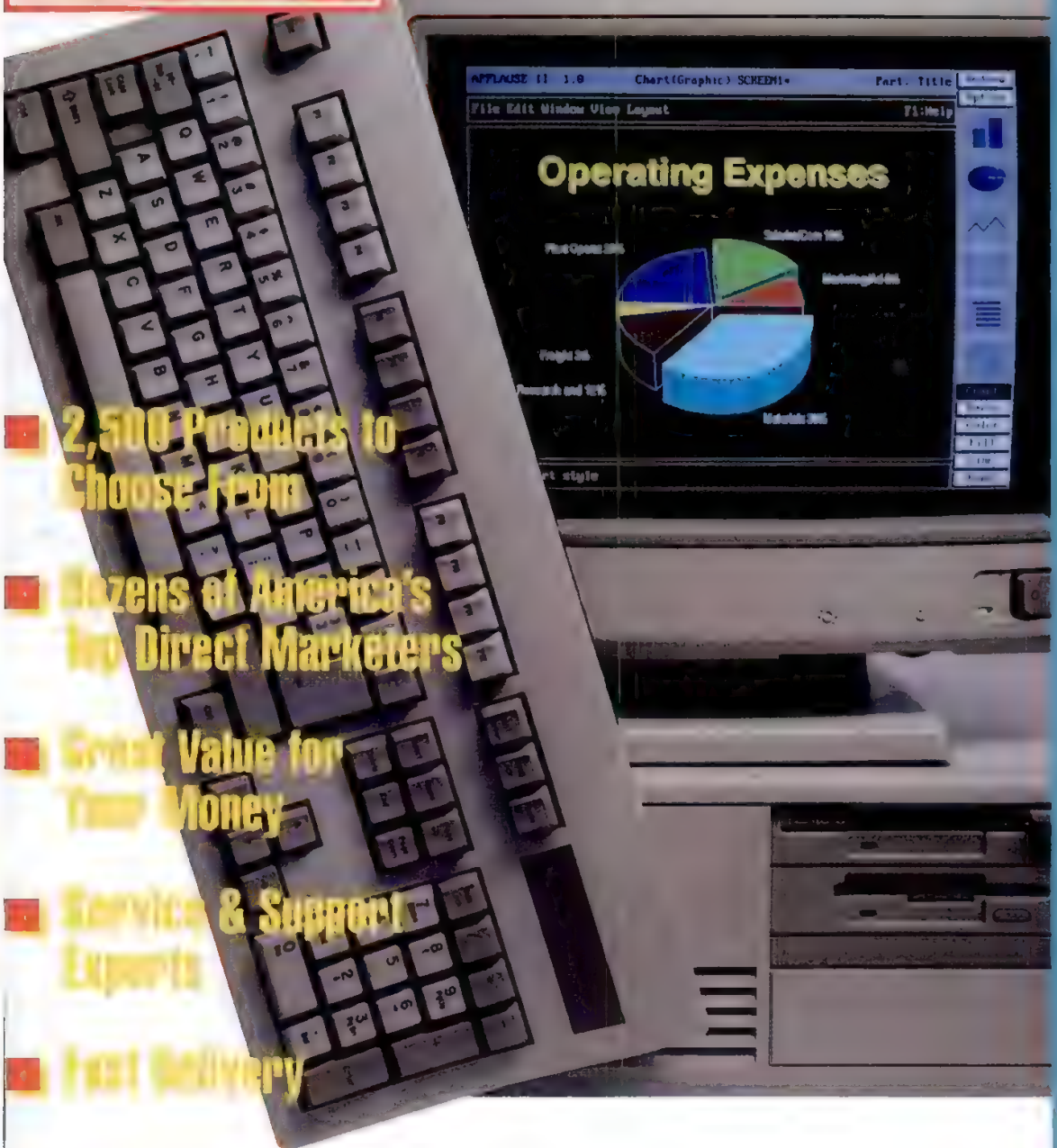

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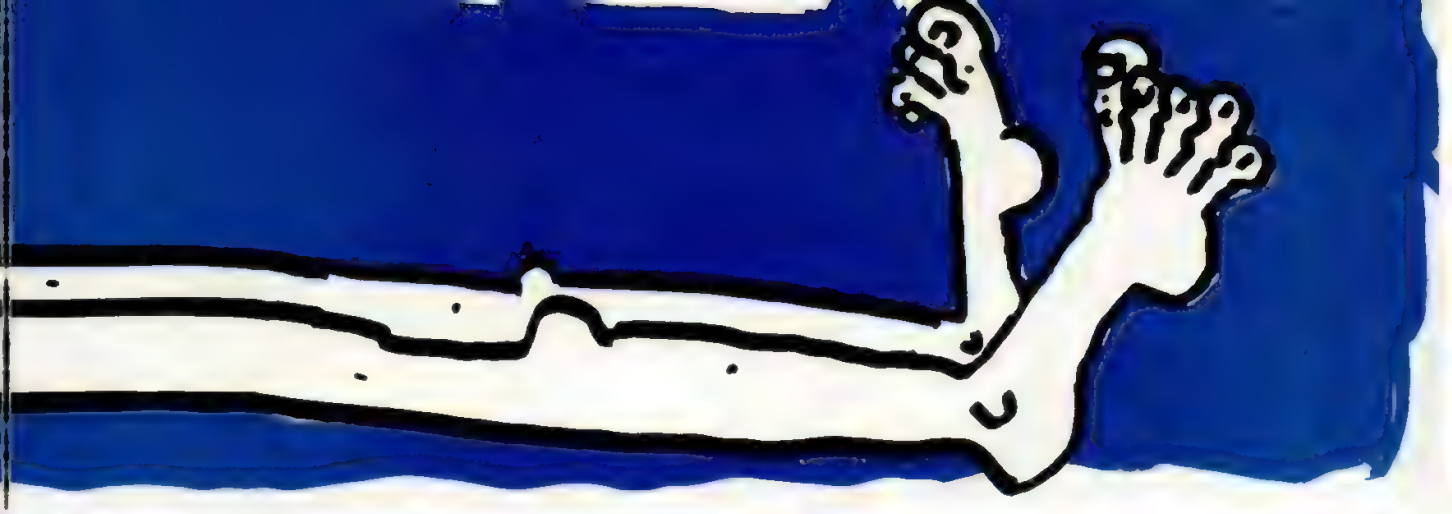

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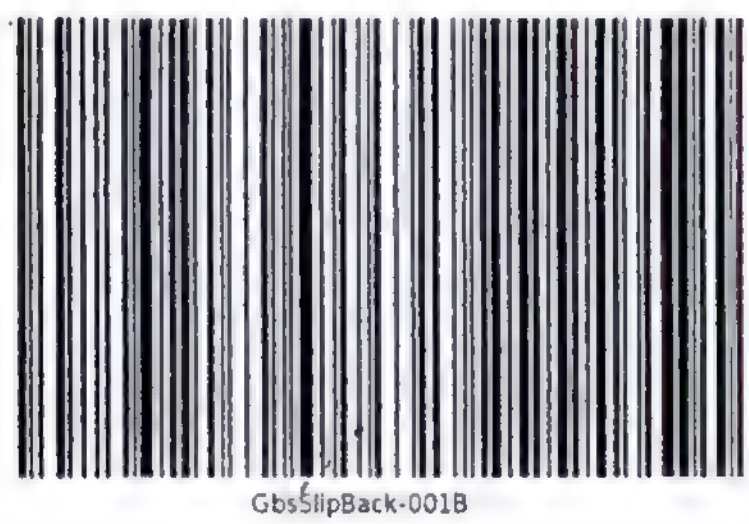

Back

1. Follow instructions on the other side

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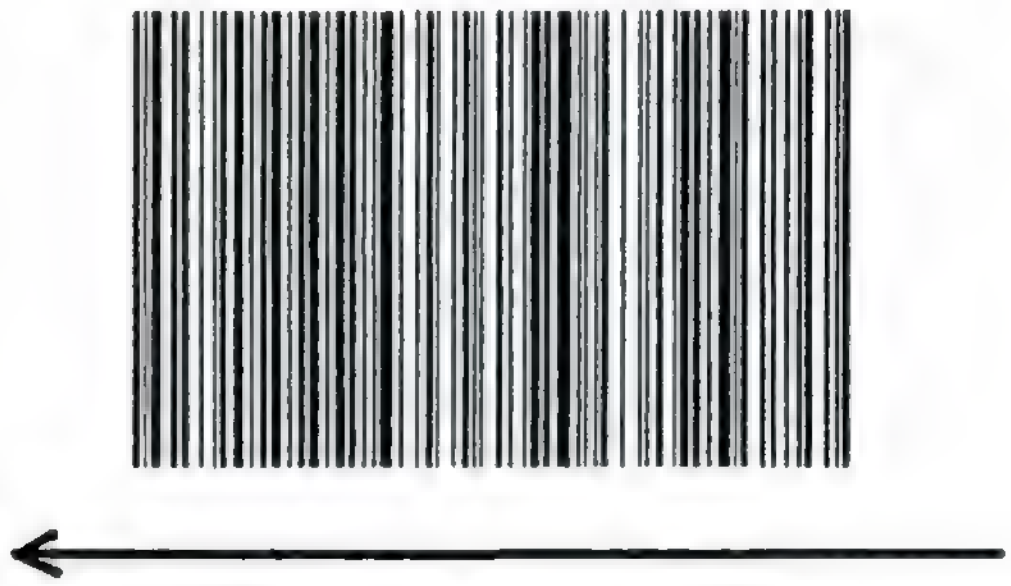

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Insert this sheet with

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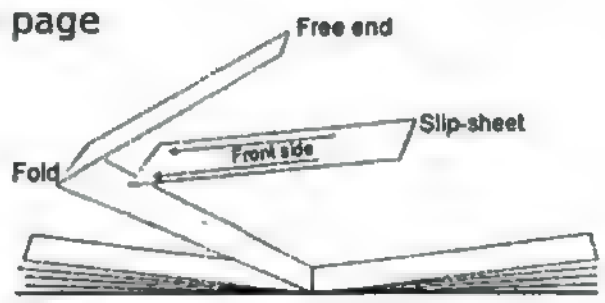

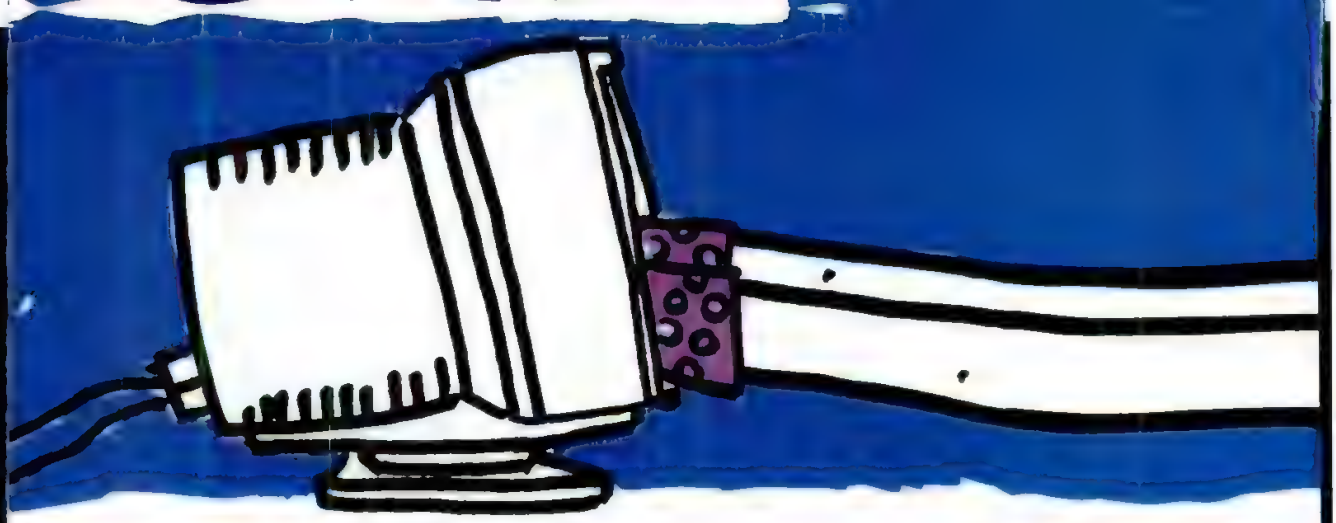

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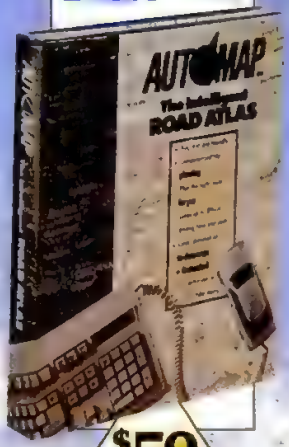

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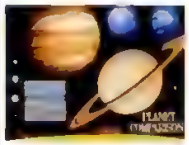

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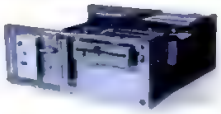
At FastMicro, we've been building PCs for six years, so when we sat down to design our next generation of desktop computers, we wanted to build in a lot of extra features and do it at a great price. We started with our desktop case. We gave it a total of seven drive bays, because we knew our customers wanted to use all kinds of hard & floppy drives, CD-Roms, tape backups and more. We made the case stronger and gave it  extra shielding, compare it to competitors' unshielded designs. We then incorporated surface mount technology throughout the system and put in a second temperature activated fan to keep the system cooler. A cooler system lasts much longer - particularly in the new upgradeable intel inside i486 designs. For reliability, performance, and extra capacity, we chose Connor's new 170mb IDE drive for our new 486 machines. We also include Super VGA on all systems and for $400, you can upgrade to the MAG Colorview 15 and the Diamond Stealth, both awarded PC Magazine Editors' Choice. We also include WINDOWS Windows 3.1 and a high resolution mouse with most systems.

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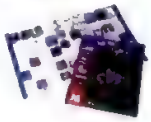
FastMicro backs up all FastData PCs with the most comprehensive support in the business. Seven day a week toll-free technical support is included for as long as you own your FastData PC. In the unlikely event a part should fail during the one year warrantee, we'll express ship you the replacement part. If we still can't resolve the problem, we'll send GE on-site service or replace the system at no charge. GE Computer Service Why should you buy your PC from one place and your software and peripherals from another? FastMicro supports you better with our complete inventory of all the leading products at low FastMicro prices that's earned us Computer Shopper's Best Buy award year after year. Plus, we'll stay in touch with you and send you our  quarterly full color catalog featuring over 400 PC products to keep your system up to date. We'd love to add you to the FastMicro family. The next time you head West, stop by and see our 107,000 square foot facility. For now, a phone call will do. You can reach us at 800-821-9000.

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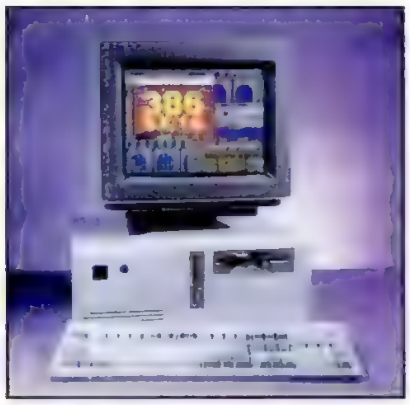

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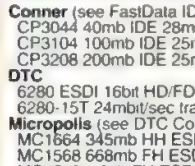

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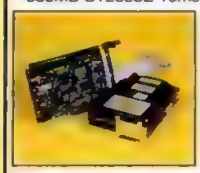

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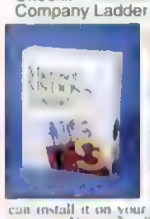

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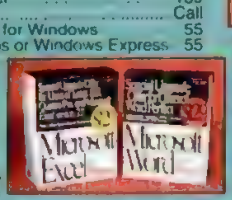

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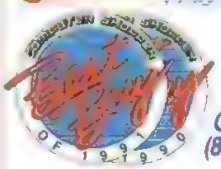

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PC MAGAZINE EDITORS' CHOICE

January 28, 1992
USA FlexNote 20

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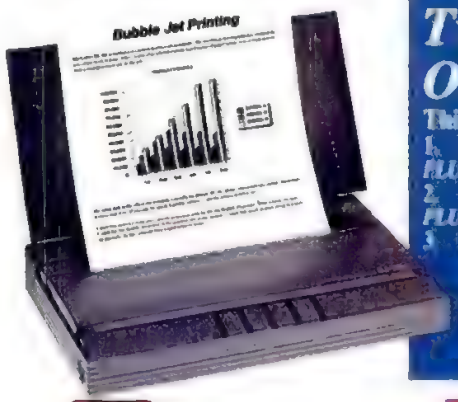

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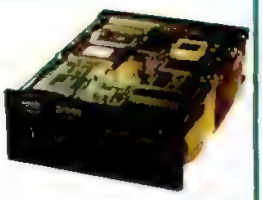

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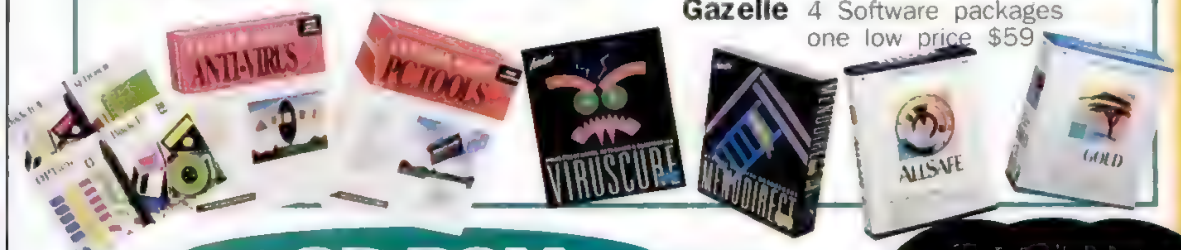

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Stan Miastkowski BYTE Magazine, April 1992

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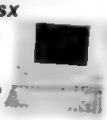

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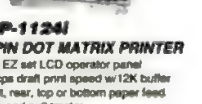

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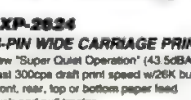

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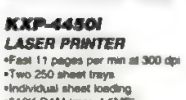

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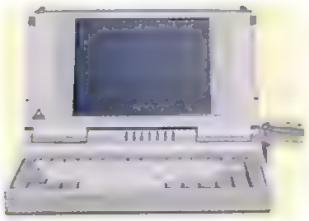

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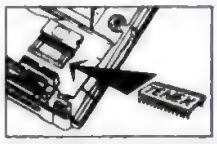

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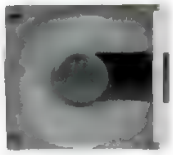

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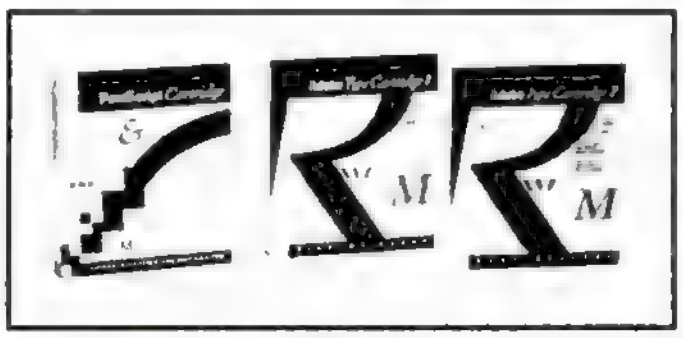

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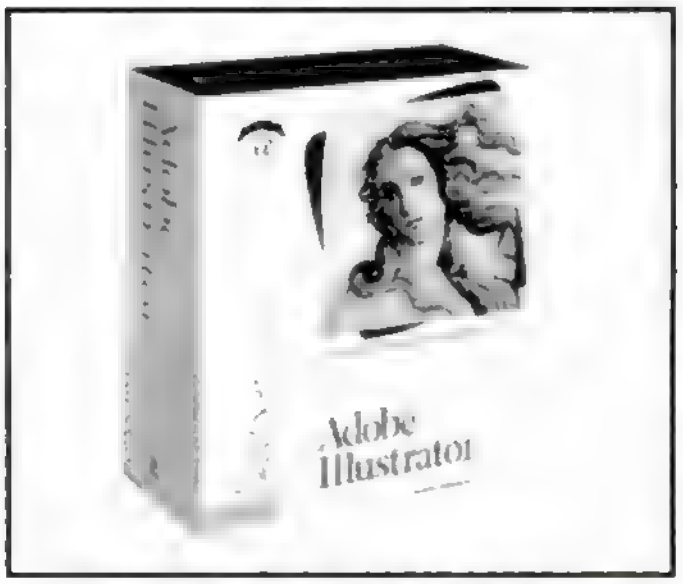

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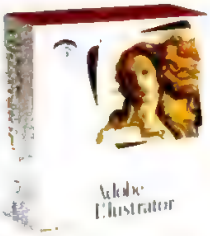

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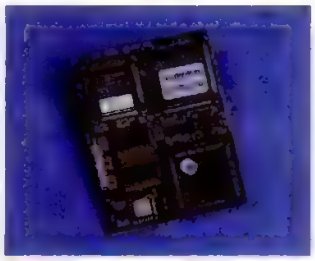

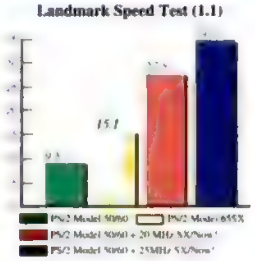

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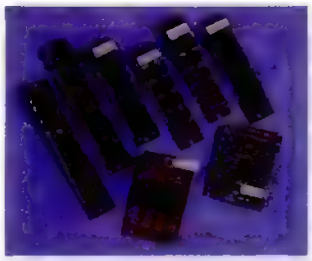

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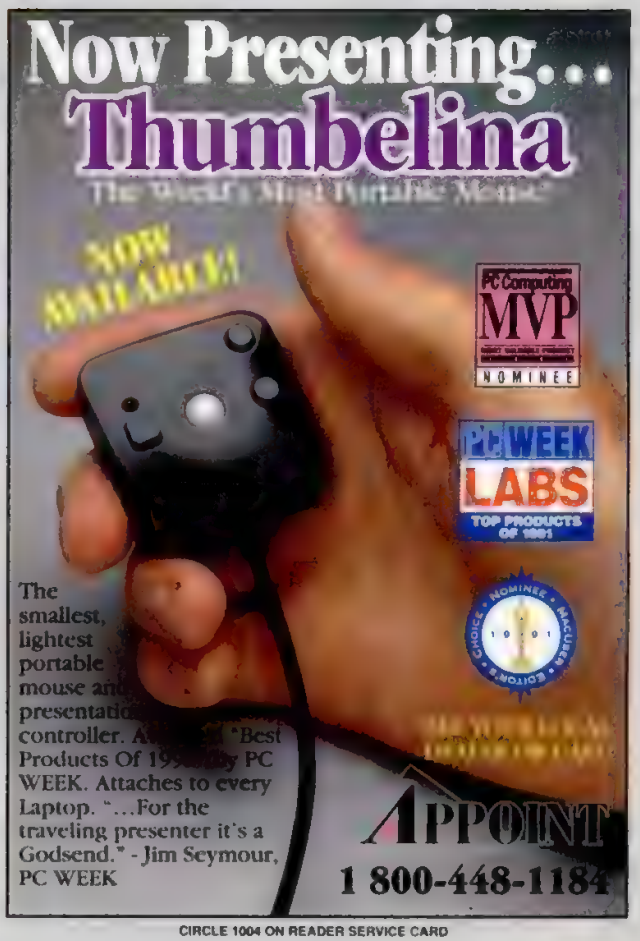

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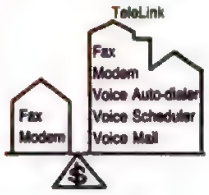

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Max. Memory and DRAM Type	8M Bytes 256k - 4M, x 8 or x 9 SIMM	1M Byte Buffer Card (Option)	N/A
Devices on Bus	MB-400P, MB-400S, MB-417	MB-400P, MB-400S, MB-417	MB-400P, MB-400S
I/P Arbitration	Concurrent First-Come-First-Serve		First-Come-First-Serve
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Bus Connector	2 4-wire RJ-11 Phone Jacks		1 4-wire RJ-11 Phone Jack
Timeout Period	S/W Control, 3 Sec. - 200 Sec.	S/W Control 6 Sec. - 100 Sec.	DIP SW Control 10 or 25 Sec.
FormFeed Selection	S/W Control, Disable/Enable	S/W Control, Disable/Enable	DIP SW Control, Disable/Enable
Max. Communication Speed	250K bps		
Enclosure	Plastic Case, Aluminum Chassis	Aluminum Case, Plastic Panels	Plastic
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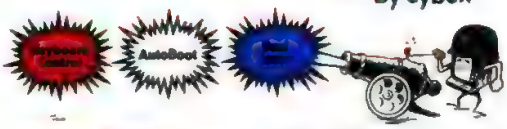

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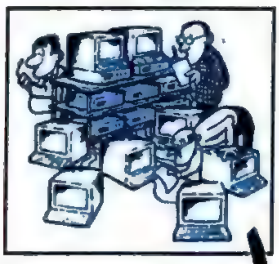

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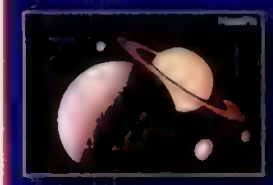

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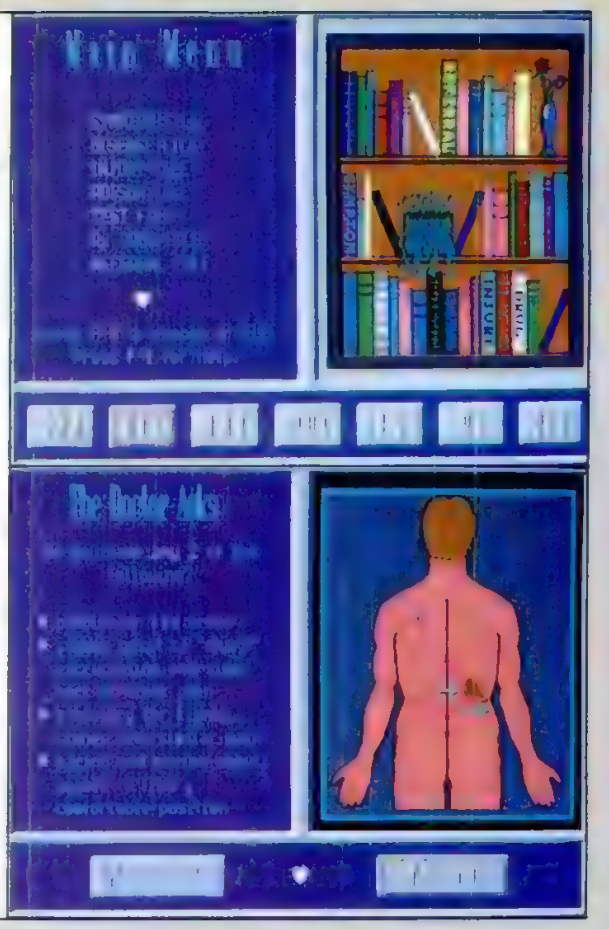

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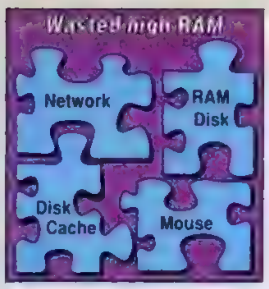

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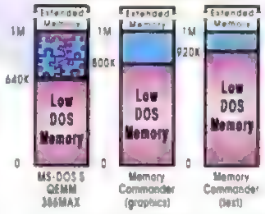

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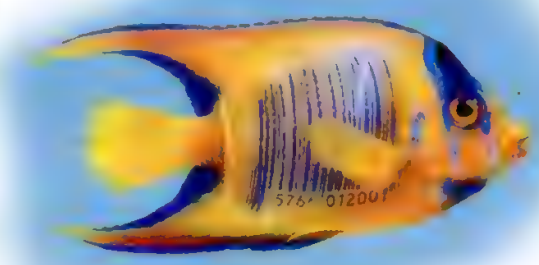

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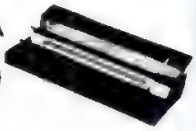

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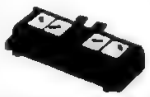

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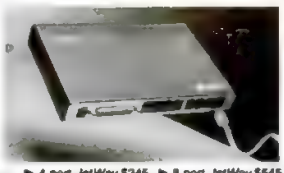

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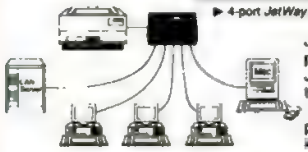

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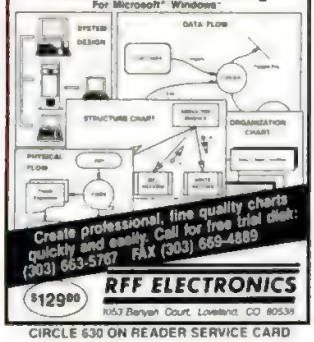

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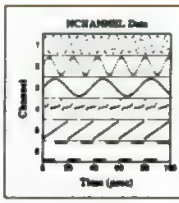

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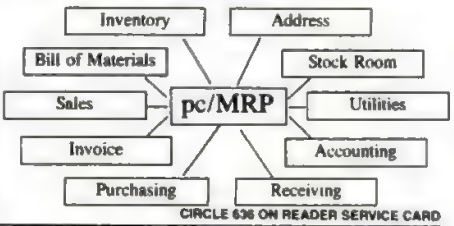

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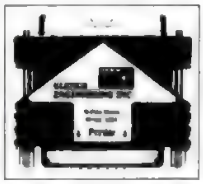

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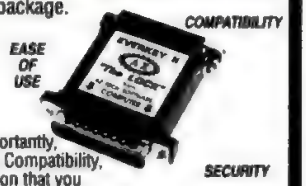

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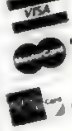

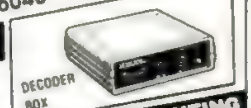

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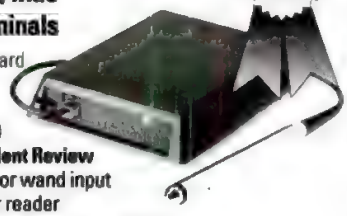

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PC 6/16/6

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14. ☐ Admin./Mgmt.
99. ☐ Other

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02. ☐ 11-25 04. ☐ 100 or more

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02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)
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04. ☐ Macintosh

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03. ☐ In 7 to 12 months
04. ☐ No definite plans

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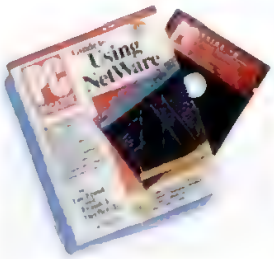

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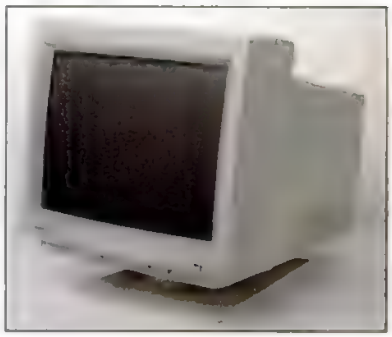
PC MAGAZINE Coming Up



■ 17-INCH MONITORS

Is your Windows desktop as cluttered as your actual desktop? Is your DTP document trapped within the confines of a 12-inch screen? Do you want to be able to see more of what you're working on? Consider the assistance of a 17-inch screen—a little bit bigger but also more expensive. *PC Magazine* compares 16 monitors as we search for the best among the biggest.

■ SUPER SERVERS

Where do you turn when your single-processing 486, running DOS and *NetWare*, runs short of processing power? Is Unix the answer? Do more processors guarantee better performance? *PC Magazine* and ZD Labs put six high-power multiprocessing super servers from Acer, ALR, Compaq, Digital, NetFrame, and Tricord to the test at the helm of a busy 96-node network, running Novell's *NetWare* 3.11 and SCO Unix MP.

■ COMMUNICATIONS SOFTWARE

The networking team looks for the software that gets the best possible performance from your modem investment. Since we last reviewed the field, powerful features such as ZModem and 16550 UART support have become standard fare for the powerful 9,600- and 14,400-bps modems. We look at over two dozen software packages and pick out the smooth operators.

■ OCR SOFTWARE

Converting your documents from paper to digital form with optical character recognition software can be an immense time-saver—or an immense frustration. We take a look at seven packages to see whether their abilities and ease of use are up to the challenges of today's business and academic environments.

■ PROJECT MANAGEMENT

Projects large and small call for careful control of schedules and resources. Project-management software can help track these tasks—and show your progress with a variety of graphical charts. *PC Magazine* looks at eight low-cost (under $895) electronic project managers, including the new *Microsoft Project for Windows* 3.0, *Project Director*, *Time Line* 5.0, and *Time Line for Windows*.

■ UTILITIES

Did you ever run a program only to receive the message, "This program requires Microsoft Windows"? WINSTART and its companion program WINGO will let you run Windows programs from your native DOS prompt or from within a DOS box. These two programs will be presented in the next issue, along with a programming discussion of how DOS and Windows communicate with each other. ■

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INTRODUCING ZIFF BUYERS' MARKET. NOW YOU CAN SCREEN THOUSANDS OF COMPUTER PRODUCTS ON-LINE.

Begin your search by selecting the product category you are interested in from the main menu including: computer systems, storage devices, printers, modems and more. In this example we chose computer systems.

Ziff Buyers' Market lets you see the most important product characteristics at a glance; technical specs, seller, service policies and current pricing.

Search Path: Computer Systems, Desktop, 386/33, 80 Mb

There are 3 Featured products. A complete alphabetical listing of 160 products follows the featured items.

May 1,1992

The search path shows we further narrowed the field by selecting desktop systems with a 386/33 chip and minimum of 80Mb hard drive You can also choose to search by price range, for example, "desktop systems less than $2000".

	Manufacturer	Type	RAM	HD	Video	Seller	Svce	Price
1	Zeos	386/33	2	107	SVGA14	Zeos	TSG	1895
	Lotus 1-2-3 for Windows, Ami Pro 2.0, Sierra DAC, WinRIX free.							
2	Insight	386/33	4	124	SVGA	Insight	GTW	1669
	You can have it all: amazing prices plus world class service.							
3	Dell	386/33	4	80	SVGA	Dell	TSG	2049
	Dell quality at even lower prices.							
4	APlus	366/33	4	120	SVGA	APlus	GS	1475
5	CompuAdd Exp	386/33	4	80	VGA	CompuAdd Ex	ST	1795
6	LodeStar	386/33	4	125	SVGA14	LodeStar	GSTW	1669
7	Magnavox	386/33	2	130	EVGA	Elect Disc	GT	1395+
8	Professional	386/33	4	120	SVGA14	Professional	GT	1565

Manufacturers and sellers use top listings to make you aware of specials and promotions—then the alphabetical listing makes it easy to scan the complete list of products that meet your needs.

0 Revise search

Please enter one or more numbers or press enter for more products:

S Service on site
G Guaranteed money back
T Toll free support
W Warranty extended
+ Credit card surcharge

Enter a number to find even more detail on the product and seller you are interested in — including complete ordering information and toll-free numbers.

Since price and product specs are constantly changing in this fast-moving industry, you'll be glad to know Ziff Buyers' Market is updated at least monthly, but in many cases daily.

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CIRCLE 142 ON READER SERVICE CARD

After Hours

Products for the Leisure Side of Personal Computing

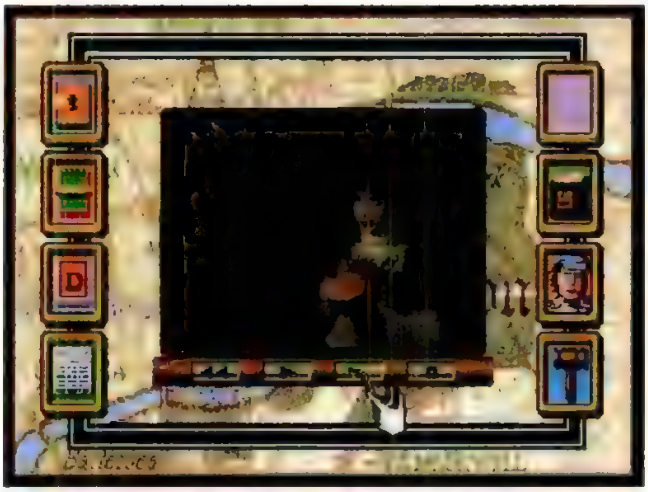
Multimedia CD-ROM Movie Brings Sherlock Holmes to Life

By Don Trivette

Four men are dead. Coincidence, or are they the victims of a 4,000-year-old curse? That's what you'll try to solve in the first of three cases on the new CD-ROM thriller, *Sherlock Holmes: Consulting Detective.*

You begin by looking over the shoulders of Holmes and his trusted assistant, Dr. Watson, as they discuss the Case of the Mummy's Curse. From that point on you direct the investigation by visiting various locales, interviewing suspects, and consulting authorities like Sir Jasper Meek, the medical examiner. Once you know "whodunnit," you visit a judge and make your accusation.

Sherlock Holmes is the first game designed to take full advantage of the multimedia PC. You can hear everything from the instructions to the interrogation of witnesses. At the outset, you hear Holmes and Watson discussing the death of a man associated with an archaeological dig in Egypt. You not only hear Holmes and Watson, you see them in full-motion video.



Holmes notices that Mrs. Weatherby, a suspect, can't open a toffee tin. Could that help solve one of the mysteries in *Sherlock Holmes: Consulting Detective*?

Buttons below the video window in the screen make this like a combination TV/VCR, letting you pause, rewind, or stop the action by clicking a button. The quality of the video image depends in large measure on the speed of your computer and CD-ROM drive. On an older-model Sony drive, for example, there are slight pauses in the speech and action; on drives with larger buffers the 15-frame-per-second action is nearly seamless. The disk—which includes "The Case of the Mummy's Curse," "The Case of the Mystified Murderess," and "The Case of the Tin Soldier"—has over 90 minutes of full-motion video.

Sherlock Holmes was made like a motion picture: 50 speaking parts were cast, 70 costumes designed, and 25 period sets constructed. A script was written and the scenes were then taped and digitized.

You conduct your investigation by "interviewing" the dozens of characters in the story—that is, by calling up short video segments. Some

CONTINUES

- **GENEALOGY** Trace your roots with *Family Tree Maker.*
- **MUSIC** *Composer Quest:* Take a multimedia tour of the great classical composers, their music, and their eras.
- **GAMES** Build your own perfect metropolis on your way to utopia with Sid Meier's *Civilization.*

ARTHUR CONAN DOYLE'S SHERLOCK HOLMES AVAILABLE ON CD-ROM

Sherlock Holmes: Consulting Detective is sanctioned by the estate of Sir Arthur Conan Doyle (1859-1930), author of the original Sherlock Holmes novels and short stories, although none of the cases included were part of his work.

If you are interested in the literary Sherlock Holmes, you need only slip *Sherlock Holmes on Disc!* from CMC Research into your computer. This CD-ROM offering has the complete text of every Sherlock Holmes story (known to fans as the "Doyle canon") along with *The Medical Casebook of Doctor Arthur Conan Doyle.*

You can read "The Man with the Twisted Lip," "The Adventure of the Priory School," and my favorite, *The Hound of the Baskervilles.* The four novels and 56 short stories involving the legendary sleuth are here.

The retrieval software has both browse and keyword features so you can find any passage, character, or setting quickly. Surprisingly, "Elementary, my dear Watson," is not found in Doyle's writings; it came instead from the theatrical presentations of the stories.—*DT* ■

List Price: *Sherlock Holmes on Disc!*, $29.95. **Requires:** 640K RAM, CD-ROM drive, DOS 3.1 or later. CMC Research, 514 NW 11th, #203, Portland, OR 97209; 800-262-7668, 503-639-3395.

CIRCLE 512 ON READER SERVICE CARD

Sherlock Holmes

CONTINUED

characters will be helpful while others will have little information. During a visit with the widow of Andrew Weatherby (click on her name in your notebook and then click on the horse-and-carriage icon to get to her), you notice she can't open the toffee tin; is she strong enough to have strangled a man? There is no set order to the investigation; you interview characters in any sequence until you can solve the case. Although the software is self-contained (it requires no hard disk installation), you *can* save a game in progress to a disk file.

Sherlock Holmes is a must for anyone with a multimedia computer. Simply stated, it's the next evolutionary step in adventure gaming.

List Price: *Sherlock Holmes: Consulting Detective*, $69.95. **Requires:** 286-based PC or better, 640K RAM, Super VGA display, sound card, CD-ROM drive, mouse, DOS 4.0 or later. ICOM Simulations Inc., 648 S. Wheeling Rd., Wheeling, IL 60090; 800-877-4266.

CIRCLE 511 ON READER SERVICE CARD

Family Tree Maker: Discover and Preserve Your Family's Roots

GENEALOGY
by Carol Levin

Every family has its oral tradition passed down from generation to generation. But as time goes on, details are lost, dates are changed, and names are forgotten. Now there's Banner Blue Software's *Family Tree Maker* ($59.99), which lets you preserve these memories electronically.

An unadorned DOS-based program, *Family Tree Maker* uses a familiar index-card structure to trace family lineage. It's very simple to use: Just open a new Family Card File and fill out a card for yourself, your spouse, and your children. Hit F4 for a new Family Card to add your parents and siblings, again for your grandparents' generation, and so forth. You can record biographical details (such as occupation and medical history), customize fields, and recount anecdotes on anyone's individual card.

Version 2.0 supports descendant and direct descendant trees, as well as ancestor and photo tree styles. It adds a new Kinship command that identifies most familial relationships and provides more space to record family lore. You can trace up to 1,200 individuals, with 99 children per individual, and go back as far as 100 A.D.

FTM does impose some restrictions. Each new name must be the spouse, parent, or child of someone already entered, so you must know the exact kinship before you start. It labels each person as a wife or husband, ignoring the status of unmarried individuals. And it's best to get lineage right the first time, since a mistake may force you to erase some entries.

The program accommodates more complex family ties. If you know your grandparents are distantly related by marriage, you can build one Family Card File for maternal relatives and one for paternal relatives, then use the Join function to integrate the two lineages. Adding stepchildren and stepparents to the equation may throw the Kinship command, but Banner Blue's free technical support can help you untangle knotty family ties.

For a touch of authenticity, Banner Blue includes antique-finish parchment on which to print your family tree. Otherwise, the program offers too few customizing options for its output; only a few border styles and one uninspired sans serif typeface are available. The package needs additional fonts.

Because of the unprintable area on laser printer output, multipage descendant trees can be misaligned and must be taped together. Ancestral trees, however, do fit neatly on one page. You won't be able to print a single descendant tree for an entire clan, but you can get close. Specify a family patriarch or matriarch, and all but the siblings of this primary individual will appear on your tree.

Family Tree Maker also compiles monthly calendars of birthdays and anniversaries, and its Family Group Sheets report biographical details for your family. Limitations aside, it's an easy way to preserve your family's memories.

List Price: *Family Tree Maker*, $59.99. **Requires:** 512K RAM recommended, DOS 2.0 or later. Banner Blue Software Inc., P.O. Box 7865, Fremont, CA 94537; 510-794-6850.

CIRCLE 507 ON READER SERVICE CARD

With *Family Tree Maker*, you can preview ancestor, descendant, and photo trees before printing them on the included antique-finish parchment.

MPC Title Explores Our Musical Heritage

by Robert Kenoff

Music appreciation cries out for multimedia, where actual musical examples can bring the topic to life. *Composer Quest*, a multimedia PC CD-ROM title from Dr. T's Music Software, aptly demonstrates how this approach can make the music of the past more accessible.

Composer Quest provides a good introduction to four centuries of classical music, from Monteverdi to Stravinsky, as well as early jazz. You can browse biographical sketches of 32 great composers, sample their music, and explore contemporaneous developments in the visual arts and history.

A time line displays the periods of music history, letting you pop up descriptive paragraphs for each period or details about the important composers of the time. You get a picture of the composer you select, along with a brief but cogent discussion of his life and work. If you're stumped by a musical term in the text, clicking on it provides a definition. The program is so easy to use that it's unlikely you'll ever need the on-line documentation.

The unique value of the program comes from the musical examples (in standard Red Book CD audio format), usually three examples per composer. Though only 30 seconds long, these sound bites are enough to give you a taste of the composer's style. Composers aren't always represented by their most important compositions, but the selections are nearly always characteristic. The one egregious misjudgment is representing Verdi—the master of vocal lyricism—

CONTINUES

Composer Quest

CONTINUED

exclusively through instrumental excerpts from his operas.

To put the music in historical context, hypertext links offer short discussions of the historical and cultural background of each musical period, as well as parallel activity in the visual arts. Illustrations supplement these discussions, though you'll need a Super VGA display to render these graphics or the composer portraits adequately.

To put your newfound knowledge to the test, *Composer Quest* offers multiple-choice quizzes on the reading material for each period. An entertaining game mode provides an imaginative way to learn to recognize the package's musical examples.

You start by listening to an unnamed, randomly selected musical excerpt. You then hop in your time machine to reach the era when you believe the piece was written. Every time you select a composer incorrectly, you're given a hint about the true composer's identity. While *Composer Quest* lacks the depth of the best music appreciation books, it offers a uniquely easy and enjoyable way to get your feet wet in our rich musical heritage. With this package, Dr. T's has set a standard for MPC software.

List Price: *Composer Quest*, $99. **Requires:** Multimedia PC with 4MB RAM, 7MB hard disk space, Windows with Multimedia Extensions, DOS 3.1 or later. Dr. T's Music Software Inc., 124 Crescent Rd., #3, Needham, MA 02194; 800-989-6434, 617-455-1454.

CIRCLE 508 ON READER SERVICE CARD

Composer Quest lets you view information about famous composers, listen to their music, or call up discussions of history and the arts.

Building Utopia: Reinvent Civilization with MicroProse Simulation

For those who are sick of civilization and its discontents, Sid Meier and MicroProse have a remedy. *Civilization*, Meier's newest simulation game, names you emperor of your own civilization; you set environmental climates and then develop governments, technology, and cultures. The game begins in 4,000 B.C. and ends, for the politically astute, when you send a group of colonists from your empire via spaceship to the Alpha Centauri star system.

Those who have played Sid Meier's games, namely *Railroad Tycoon*, will find *Civilization*'s ethic familiar: power with responsibility. Similar to Maxis's *SimCity* and *SimEarth*, *Civilization* requires you to juggle any number of complex situations of your own design. No move is independent of another; any strategic decision made at one juncture affects others down the road.

To start, select your territory: Earth or a planet of your own creation. Form a tribe, select the number of rival civilizations (up to seven), and set the game's level of difficulty from chieftan up to emperor. This last setting is not quite historical; I can't think of any prehistoric tribes headed by emperors.

Civilization's goal is to develop a successful society. If you rule with an iron fist, your people will revolt because you are spending too much money on the military instead of on food, housing, and cultural institutions. To avoid anarchy, change your government from monarchy to democracy when your civilization's population nears its apex. A cabinet of advisors (available as necessary either from the menu or in a pop-up window) counsels you as you develop your strategy.

Civilization's screen is well-equipped. As your civilization progresses, you will be updated on every matter of state from your military's activity to treasury holdings to population size. The map of your empire, which serves as the game's main playing board, starts out as a primitive one; its scope increases as you develop the scientific and social wherewithal to expand your empire. For example, you must invest in scientific research to develop astronomy before you can build boats to explore other continents.

With some of the best VGA graphics in this genre, an instantly gratifying point-and-click interface, and socioeconomic scenarios sophisticated enough to challenge any strategist, MicroProse's *Civilization* balances serious politics with fun. Play it well, and you might consider a trip to New Hampshire in 1996.

List Price: *Civilization*, $69.95. **Requires:** 640K RAM, DOS 3.0 or later, EGA display or better. MicroProse Software Inc., 180 Lakefront Dr., Hunt Valley, MD 21030; 301-771-1151.

CIRCLE 509 ON READER SERVICE CARD

Create your own burgeoning metropolis with Sid Meier's *Civilization*, shown here in VGA resolution.

Lucasfilm's Monkey Island 2: A Spit-acular Pirate Adventure

GAMES
by Eric Berlin

In a word, *Monkey Island 2: LeChuck's Revenge* is very "spit-intensive." Lucasfilm Games' sequel to its hit adventure *The Secret of Monkey Island* is also high on ingenuity, humor, devious challenges, and gorgeous animation and sound.

Monkey Island 2 picks up with hero Guybrush Threepwood just months after his triumph over the dreaded Ghost Pirate LeChuck. Not content to rest on his laurels and merely spin tales of past victories, Guybrush has come to Scabb Island in search of the biggest treasure of them all: Big Whoop. But there's plenty of obstacles in Guybrush's way, and more than enough bad guys to conquer—including, once again, the Ghost Pirate LeChuck, back from the dead and in a really bad mood.

Lucasfilm has graced *Monkey Island 2* with two levels of play. Its difficult mode is just that; if you can solve it in less than a month without the hints provided by Lucasfilm's 900 number, you're just what we need to solve more gripping problems—like world hunger.

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Monkey Island 2

CONTINUED

You'll most likely spend large periods of time roaming around the expansive world of the game, wondering what the heck to do next. Luckily, you won't mind wandering around, because there are so many humorous characters to meet, including a deaf dry cleaner and the grossly gluttonous mayor of Phatt Island.

Talking to people is as easy as clicking on what you want to say next, usually from a list of five or six choices. In general, what you say has no effect on the course of the game (major events cannot be thwarted with the wrong clever retort), but you may want to try different choices just to see what humorous situations can arise.

The game's interface is a breeze: Just point to a location on the screen and click, and Guybrush walks to that location. A message bar just below the animation identifies any object your cursor passes over. Beneath the message bar are the nine main commands and your inventory list.

In addition to the wonderful animation and simple interface, Lucasfilm has also broken new ground in sound with its iMUSE Music System, developed by Michael Land and Peter McConnell. Rather than having the entire score programmed in advance, the iMUSE system spontaneously generates a musical score, based on Guybrush's location and mood. The programmers put in different algorithms for different scenes (you don't want the same music playing in a swamp and at Mardi Gras) and iMUSE takes it from there. The effect is quite subtle, but if you go back and play the same sequence several times, you will definitely notice changes within the musical score.

In *Monkey Island 2*, Lucasfilm Games' latest adventure for Guybrush Threepwood, one of the favorite pursuits on Booty Island is the pirates' spit contest.

Monkey Island 2 is well worth the money in terms of ingenuity, humor, challenge... and spit. Oh yes, I forgot about the spit. Be ready to enter (and win) a spitting contest, make sure you can get other characters to spit, and practice your target spitting in case you need to get out of a perilous situation. Sure, it's juvenile, but *Monkey Island 2* is also a brain busting lot of fun. ■

List Price: *Monkey Island 2: LeChuck's Revenge*, $59.95. **Requires:** 640K RAM, 9MB hard disk space, VGA display, DOS 3.0 or later. Lucasfilm Games, P.O. Box 10307, San Rafael, CA 94912; 800-782-7927.

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by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

At This Airport, the Widebodies May Be Inside the Terminal

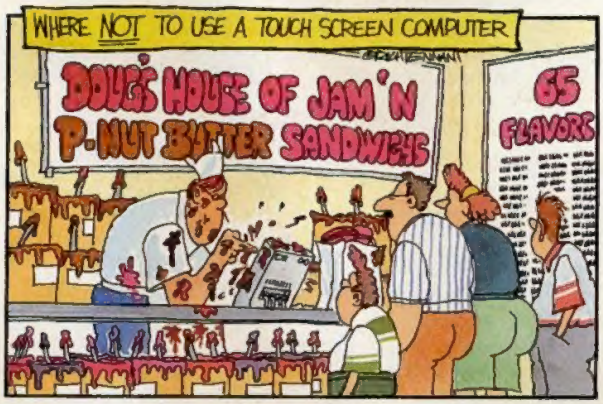
"The [NEC 486SX/C] Prospeed has drawbacks in its hefty price tag and bulk. Set to be shipped this week, the 486SX weighs in at close to 17 pounds and measures almost 45 inches wide by 16 inches deep. Although the 486SX/C may be a viable option for weight training it would be difficult to lug around an airport."

—*PC Week* (U.K.), November 26, 1991

Press Releases We Never Quite Finished Reading

"Stress Technology Incorporated, Dubois Applied Technology, and dh Engineering announces [sic] the Fourth Annual Finite Element Analysis User's Conference June 24, 1992 . . . ."

Not only does a typo (Itinteractively) appear in the RightWriter 5.0 ad in this PC Zone mailer, it also misspells the name of the publisher of this grammar/spell-checking package, Prentice Hall.



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—CompuAdd Express winter 1992 catalog

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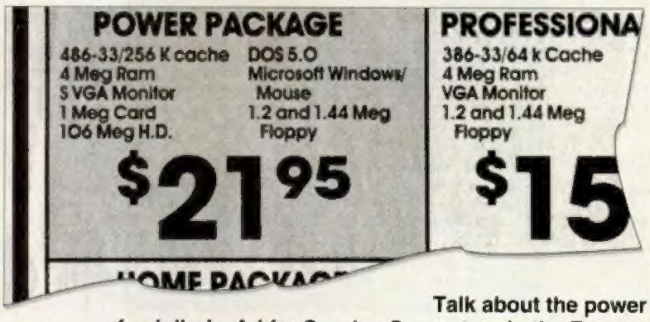
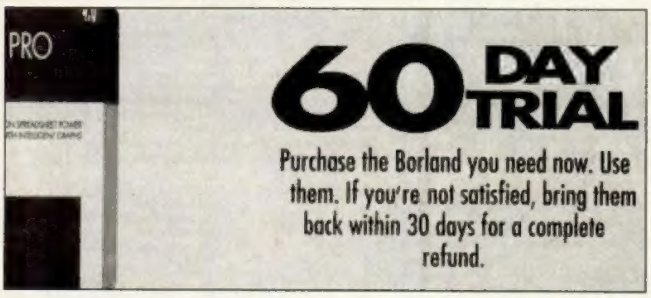
—PC keyboard ad, V-Com Enterprises, Duarte, California



Talk about the power of a dollar!—Ad for Sunrise Computers in the Eugene *Sunday Oregonian*, January 19, 1992



So how long is the free trial?—Borland ad in the *Toronto Globe and Mail*, February 27, 1992

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—Microsoft Solution Series catalog

Never mind what Compaq says in its brochure; the battery gauge on its LTE Lite line measures time in hours and minutes.

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of each entry are considered. Winners this issue: Dennis Vaughan (45-inch-wide portable), John W. Beland (Itinteractively, Prentise Hall), Terrence A. Quinn (120 megabytes on a floppy disk), Mike Circo (function keys for southpaws), Douglas G. Plane ($21.95 Power Package), R. Kirk Bailey (Borland money-back), Doug Harman (8-year perpetual calendar), Brent W. Minchey (Compaq battery gauge).

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